Trouble-shooting instructions : BMW-5022

BOSCH system : Motronic M 1.3

Make of vehicle : BMW

Basic microcard : KFZ-00..

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SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

*BMW 530i with and without catalytic converter as of 02.88
Engine: 3.0 l / 6 cyl.
*BMW 535i with and without catalytic converter as of 02.88
Engine: 3.5 l / 6 cyl.

* Motronic system M 1.3 with self-diagnosis and flashing-code output (55-pole plug).

* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 09.01.89.

Note:
Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.

Pay attention to operating instructions for KTS 300.
Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 463 196 (BMW).

* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units).

* The self-diagnosis test table takes account of both the KTS 300 and the flashing code and is arranged according to fault-code nos. indicated by the KTS 300. In some cases, the "fault indication" column includes two types of fault which can be optionally indicated by the tester, e.g:
Short-circuit to ground (= 1st type of fault)
Short-circuit to positive (= 2nd type of fault)

SPECIAL FEATURES (CONTINUED)

* Initiation (stimulation) and continuation of the flashing-code fault output are effected by pressing the full-load switch 5 times (accelerate to full throttle 5 times within 5 seconds with ignition switched on).
  Every flashing code is continuously output until continuation is effected.
  As a last step, the flashing code 0 0 0 0 or 1 0 0 0 appears = end of output.
  The fault memory is cleared by closing the full-load switch for at least 10 seconds during output of the flashing code "end of output".
  Termination of self-diagnosis: Switch off ignition.

* Control unit with variant encoding.
  Important:
  Please refer to basic instructions for information which has to be given when ordering control unit.

* Group injection: Division into 2 groups which inject at different times (except during start phase).
  Synchronization by way of sensor on ignition cable of cyl. 6.
  Group 1: Cylinders 1,3,5
  Group 2: Cylinders 2,4,6

* Adaptive lambda closed-loop control and tank ventilation with pulsed valve (for cat.).

* Note on trouble-shooting:
  If vehicle computer and/or burglar alarm fitted, attention is to be paid to the following:
  If the code for depriming the system was entered incorrectly or if there is a defect in the vehicle computer/burglar alarm, positive is switched to term. 38 of the Motronic control unit.
  The engine cannot be started.
  For rapid testing, disconnect vehicle computer and alarm-system module and repeat attempted starting (no voltage at term. 38).

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
  Therefore, disconnect Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaints (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel injection).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*		Self-diagnosis
*											Voltage at control unit
*											Engine-speed/reference mark sensor
*		*			*	*					Fuel pressure
*		*				*	*				Solenoid-operated injection valves
		*	*		*						Throttle-valve switch
	*	*	*	*	*	*					Air-flow sensor
	*	*	*								Idle actuator
*	*	*	*								Air-intake system
		*									Idle speed, CO
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
*				*							High-voltage sensor
		*									Overrun cut-off
		*	*	*							Interference-suppression resistors
		*	*	*							Noise test
					*						Interference
					*						Throttle valve
					*						Fuel delivery
	*	*	*				*				Tank vent
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*		Control unit

For production reasons:
continued on the following
coordinate.

SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
No exchange of data	—	—	Prerequisite for fault output: Leads to diagnosis plug/fault lamp and power supply for control unit O.K.	13 55 15 18 37	———
Control unit Digital section (computer) defective	1	1211	Control unit defective.	—	———
Relay Fuel pump Open-circuit/short-circuit to ground Short-circuit to positive	3	1261	Fault 1: Short-circuit to ground or open-circuit (op. circ.). Fault 1 is only detected if other output stages are defective. Fault 2: Short-circuit to positive: Detach pump relay and measure voltage (with respect to ground) in frame (term. 86) with ignition switched on: Resistance of relay coil (term. 85/86): Test lead to control unit (term. 3).	3	10...15 V Approx. 50...150 Ω
Idle actuator Two-winding rotary actuator 1st winding/ single-winding rotary actuator Two-winding rotary actuator 2nd winding Open-circuit/short-circuit to ground Sh.-circ. to positive	4 22	1262	Fault code 4 (22) points to current path from control unit term. 4 (22) to idle actuator (ZWD*) term. 3 (1). Test leads and plug connection of actuator for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive. Winding resistance at +15...+30°C between connections 3 and 2: between connections 1 and 2: * = Two-winding rotary actuator (ZWD) fitted.	4 22	17...23 Ω 19...25 Ω
Valve Tank ventilation Open-circuit/short-circuit to ground Short-circuit to positive	5	1263	Only CAT models have tank ventilation valve. Test lead for contact with ground or positive. Valve winding resistance at +15...+30°C: If lead and valve O.K., control unit is defective. Open-circuit (op. circ.) is not detected!	5	35...55 Ω
Air-flow sensor/ air-mass meter Signal too low Signal too high	7	1215	Signal too low: Test lead to air-flow sensor term. 2 for short-circuit to ground. Open-circuit in leads to term. 2 and term. 3 or term. 4 and term. 3 jumpered. Signal too high: Test lead to term. 4 for open-circuit. Test leads to term. 4 and term. 2 for short-circuit to positive. Continued on next Coordinate.	7 12 26	———

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Air-flow sensor (continued)			Basic tests: Test resistances at air-flow sensor: between term. 2 and term. 4 (deflect sensor flap): between term. 3 and term. 4: Measure wiper voltage at term. 2 with plug connected and ignition switched on: Sensor flap in off position: Slowly deflect sensor flap as far as full load:		 8...2500 Ω 500...1100 Ω 0,2... 0,3 V Greater than 4,2 V
Lambda closed-loop control Outside min. range Outside max. range	10	1222	Test CO content (ahead of catalytic converter): Test intake system for leaks. Test fuel pressure. Injection valves or sensor defective.	28	0,2...1,2 vol.%
Fault lamp Open-circuit/short-circuit to ground Short-circuit to positive	15	—	Test lead to fault lamp (if provided) for short-circuit to ground and short-circuit to positive. Open-circuit (op. circ.) is not detected!	15	———
Injection valves (Group 2) Open-circuit/short-circuit to ground Short-circuit to positive	16	1252	Fault: Short-circuit to ground, to UB or open-circuit in joint positive/negative lead. Test lead and valves 1, 3, 5 for short-circuit/open-circuit; if O.K., control unit is defective. Note: Open-circuits in individual injection valves are not detected.	16	4,8...5,7 Ω (3 valves in parallel) 14,5...17 Ω (1 injection valve)
Injection valves (Group 1) Open-circuit/short-circuit to ground Short-circuit to positive	17	1251	Fault: Short-circuit to ground, to UB or open-circuit in joint positive/negative lead. Test lead and valves 2, 4, 6 for short-circuit/open-circuit; if O.K., control unit is defective. Note: Open-circuits in individual injection valves are not detected.	17	4,8...5,7 Ω (3 valves in parallel) 14,5...17 Ω (1 injection valve)
Relay Sensor heater Open-circuit/short-circuit to ground Short-circuit to positive	23	1264	Test lead from control unit term. 23 to relay term. 85 for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive. Detach relay and measure voltage (with respect to ground) in frame (term. 86) with ignition switched on: Resistance of relay coil (term. 85/86):	23	 10...15 V Approx. 50...150 Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Lambda sensor Open circuit Grond short Short to B+	28	1221	Test lead for open-circuit, short-circuit to ground and short-circuit to positive (short to B+). Watch out for worn cable insulation! Sensor heater defective. Sensor clogged.	28	———
Speed signal incorrect/no signal	29	———	Test lead for open-circuit, short-circuit to ground and short-circuit to positive. If leads and plug connections are O.K., continue trouble-shooting in instrument cluster.	29	———
Battery voltage too low too high	37	1231	Supply voltage for control unit too low: Test voltage dips at positive and ground terminal. Charge battery. Supply voltage for control unit too high: Test alternator regulator.	18 19 (+) (-)	Greater than 9 V (with engine running) Less than 16 V (with engine running)
ASR/MSR interface Short to B+	38	———	Test lead to vehicle computer/burglar alarm for short-circuit to positive (short to B+). If lead and plug connection are O.K., continue trouble-shooting in vehicle computer/burglar alarm.	38	———
Air cond. readiness/AC comp. sign. Comparison not O.K.	40	———	Test lead from control unit term. 40 to A/C compressor for short-circuit to positive. Test lead from control unit term. 41 to A/C switch (A/C readiness) for open-circuit.	40 41	———
Air-temp. sensor Op.circ./sh. to B+ Short to ground	44	1224	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to ground (short to ground) and short-circuit to positive (sh. to B+). Temperature-sensor resistance: at +15...+30°C:	44	1450...3300 Ω
Engine temp. sensor Op. circ./sh. to B+ Short to ground	45	1223	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to ground (short to ground) and short-circuit to positive (short to B+). Temperature-sensor resistance: at +15...+30°C: at approx. +80°C:	45	1450...3300 Ω 280... 360 Ω
Transmission identification Short to ground	51	1278	Applies to electronic transmission control (GS): Test lead for short-circuit to ground (short to ground) or corresponding output in transmission control unit defective. Term. 51 is open on vehicles without GS.	51	———

SELF-DIAGNOSIS TEST TALE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Idle switch Short to ground	52	1232	Fault: Idle contact (in throttle-valve switch) permanently closed or short-circuit to ground (short to ground) in lead. Idle contact closed in off position: Actuate throttle valve somewhat:	52	 Approx. 0 Ω Infinity Ω
Full-load switch Short to ground	53	1233	Fault: Full-load contact (in throttle-valve switch) permanently closed or short-circuit to ground (short to ground) in lead. Full-load contact closed in full-throttle position: Release accelerator pedal somewhat:	53	 Approx. 0 Ω Infinity Ω
Converter clutch/ Driving pos. switch Comparison not O.K.	54 (24)	——	Note: Fault code 24 corresponds to fault code 54 Applies to electronic transmission control (GS): Test lead from control unit term. 54 for short-circuit to ground. If lead O.K., continue trouble-shooting in electronic transmission control. Term. 54 is open on vehicles without GS.	54	——
CU output stages with fin.cntling el. defective	100	——	CU = Control unit. Test following components and leads for open-circuit, short-circuit to ground and short-circuit to positive: Idle actuator, injection valves, fuel pump relay, tank ventilation valve and fault lamp if fitted.	4 22 16 17 3 5 15	——
No fault stored		4444 or 1444	Continue trouble-shooting with trouble-shooting chart.	——	——

Pressure regulator
Fuel pressure — 2,0 l: 2,3...2,7 bar; 2,5 l: 2,8...3,2 bar

Electric fuel pump
Delivery
(measured in return): min. 800 cm ^{3} /30s

Supply voltage
(under load): min. 12 V

Intake-air temperature sensor
Internal resistance
measured at air-flow sensor
between term. 5 and term. 4

at ambient temperature
(+15°C...+30°C): 1450...3300 Ω

Coolant temperature sensor
(plug color blue)
Internal resistance

at + 15° C...+ 30° C : 1450...3300 Ω
with engine at operating
temperature (approx. +80° C): 280... 360 Ω

Solenoid-operated injection valve
Internal resistance
at ambient temperature
(+ 15° C...+ 30° C): 14,5... 17 Ω

Air-flow sensor
Internal resistance between
term. 2 and term. 4 : 8...2500 Ω (*)
term. 3 and term. 4 : 500...1100 Ω

(*) Slowly deflect sensor flap as far as it will go. Fluctuating increase in resistance; slight decrease towards end.

Engine-speed/reference-mark sensor
Internal resistance
between term.1 and term.2 at
ambient temperature (+15°C...+30°C): 400...800 Ω
Air gap: 0,8 ± 0,5 mm

Throttle-valve switch
Resistance value of idle contact
term.1 (6)* and term.2 (4)*: approx. 0 Ω
Resistance value of full-load contact
term.3 (5)* and term.2 (4)* : approx. 0 Ω

Idle actuator
Internal resistance
at +15°...+30°C between
term.1 and term.2 : 19...25 Ω
term.3 and term.2 : 17...23 Ω

Lambda sensor
Resistance value of heater winding
(sockets 3 and 4 in 4-pole pin
terminal for lambda sensor) : 1...15 Ω

Ignition coil
Primary resistance: approx: 0,5 Ω
Secondary resistance:
Rod-type coil 4300... 7700 Ω
Plastic coil (new) 6500...11500 Ω

Interference-suppression resistors
High-voltage distributor rotor: 1 k Ω
High-voltage distributor domes: each 1 k Ω
Spark-plug connectors: each 5 k Ω
Spark plugs: 5 k Ω
Ignition coil: 1 k Ω

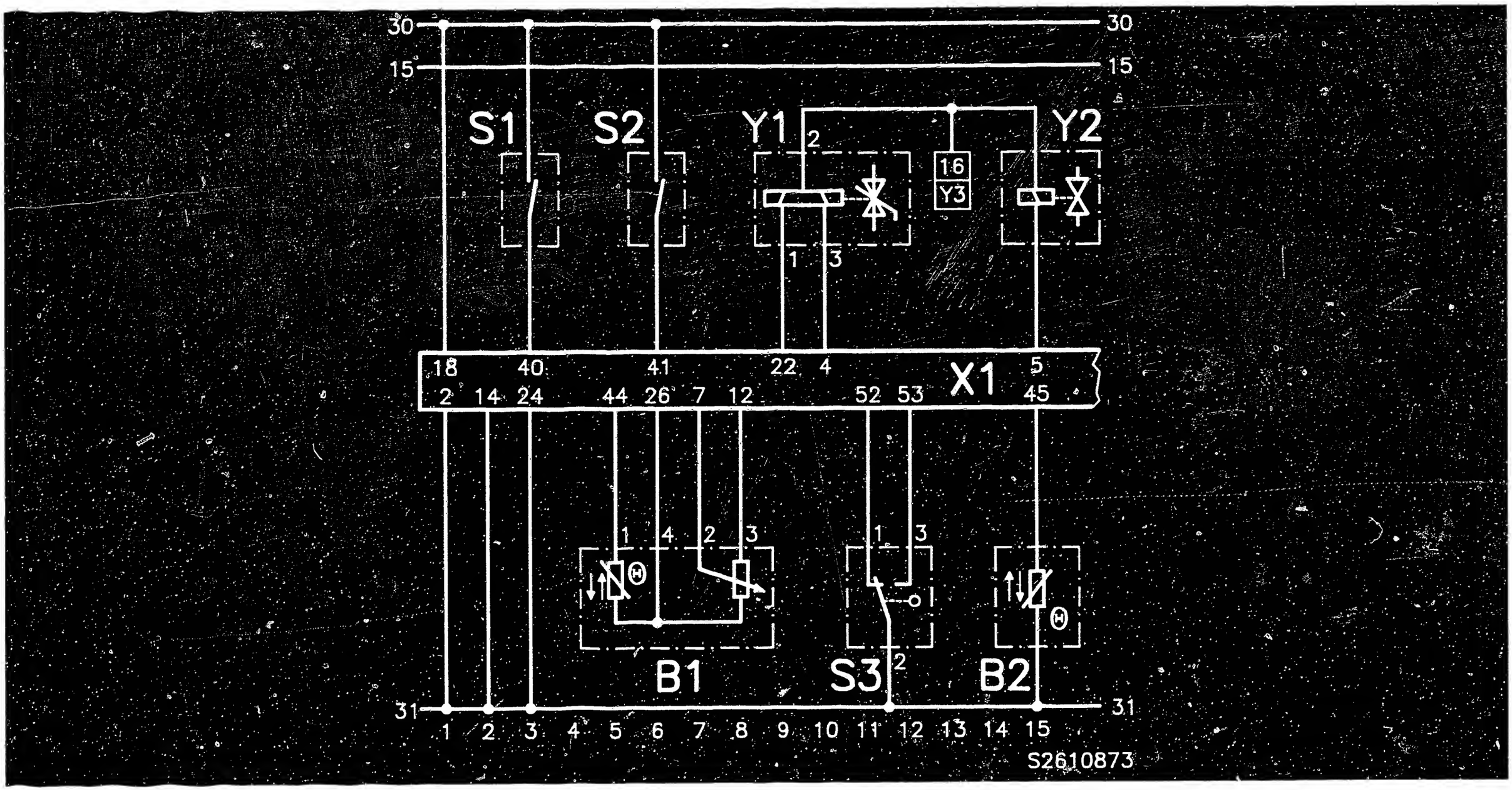
*) Number in brackets applies to version with electronic transmission control

TEST SPECIFICATIONS (CONTINUED)

High-voltage sensor: Internal resistance between term.1 and term. 2:	approx.	0,2...1 Ω
Tank ventilation valve: (catalytic-converter vehicles only) Internal resistance at ambient temperature (+15°C...+30°C):		35...55 Ω
Idle test: Engine at operating temperature, switch off loads.		
Idle speed	2,0l:	760 ± 40 min $^{-1}$
	2,5l:	760 ± 40 min $^{-1}$
Ignition angle	2,0l:	4 ± 5° CS
	2,5l:	10 ± 5° CS
(Automatic transmission on N or P)		
CO content: without catalytic conv. Adjust mixture at bypass screw in air-flow sensor: Counter-clockwise direction = leaner mixture Clockwise direction = richer mixture.		1,0 ± 0,5 vol.% CO
Catalytic-converter vehicles: (Measure CO ahead of catalytic converter)		0,7 ± 0,5 vol.% CO

Please refer to equipment and Autodata microcard for settings as regards valve clearance and other engine-related data.

For production reasons:
continued on the following
coordinate.



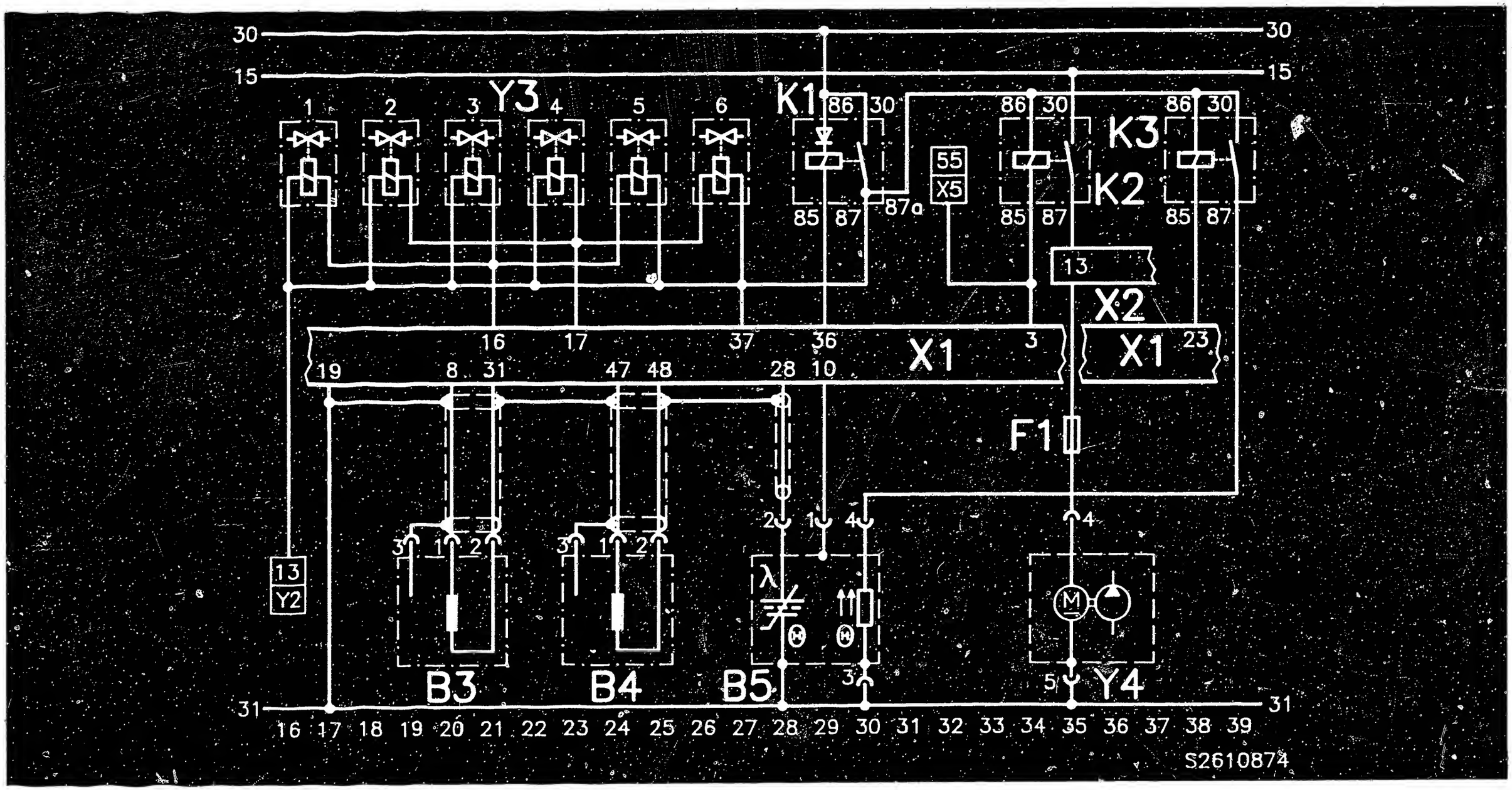
ELECTRICAL TERMINAL DIAGRAM

B1 = Air-flow sensor
B2 = Coolant temperature sensor
S1 = Switch to A/C compressor
S2 = Switch to A/C
S3 = Throttle-valve switch (manual transmission)

X1 = Motronic control-unit plug
Y1 = Idle actuator
Y2 = Tank ventilation valve (cat.)
Y3 = Solenoid-operated injection valves

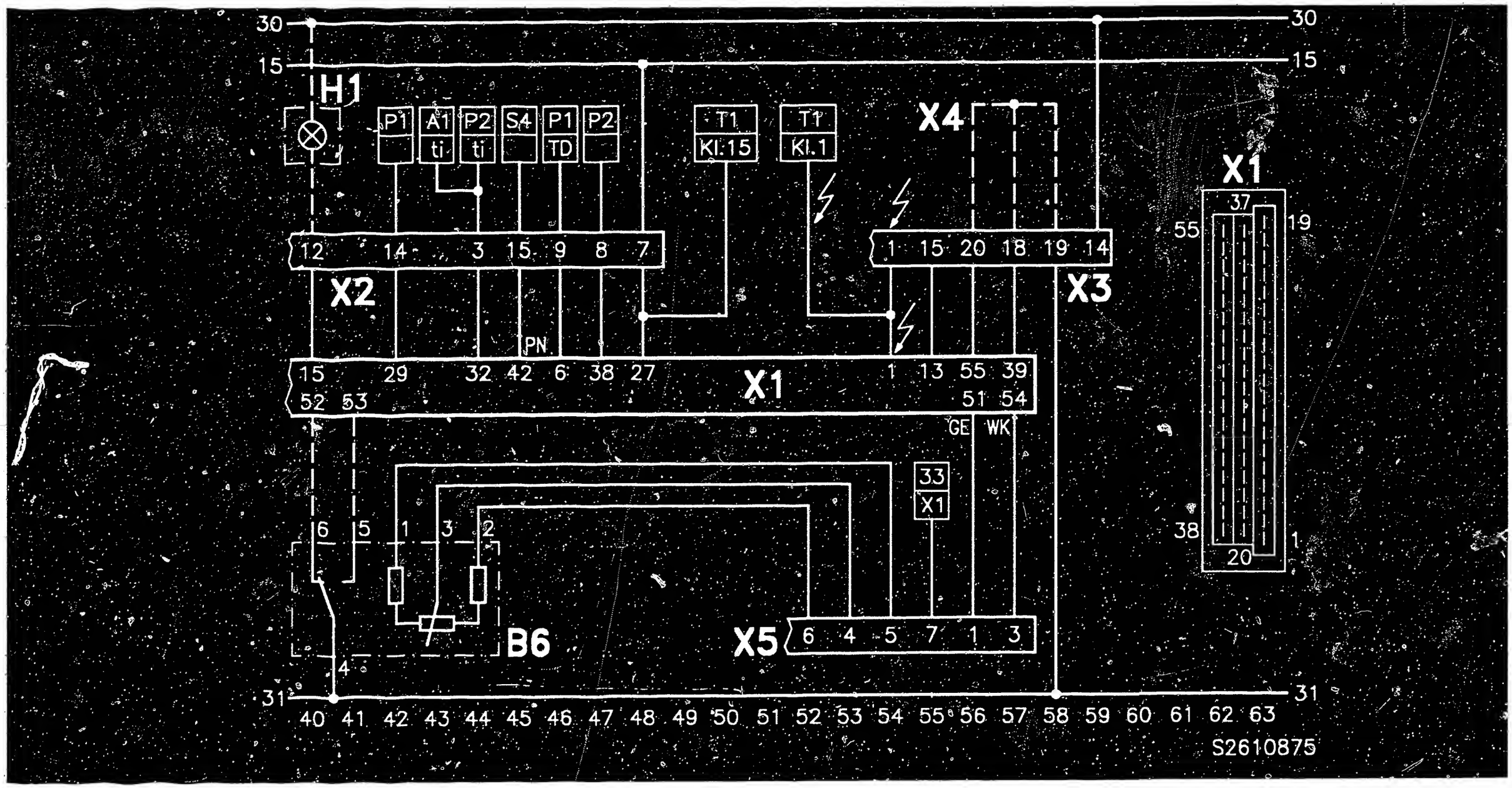
A19 ⟹

A20 ⟺



ELECTRICAL TERMINAL DIAGRAM (continued)

B3 = High-voltage sensor
B4 = Engine-speed/reference-mark sensor
B5 = Heated lambda sensor (cat.)
F1 = Pump fuse (No. 23)
K1 = Main relay
K2 = Pump relay
K3 = Sensor heater relay (cat.)
X1 = Motronic control-unit plug
X2 = Engine plug
X5 = Plug connection to transmission control unit (for vehicle with transmission control)
Y2 = Tank ventilation valve (cat.)
Y3 = Solenoid-operated injection valves
Y4 = Electric fuel pump

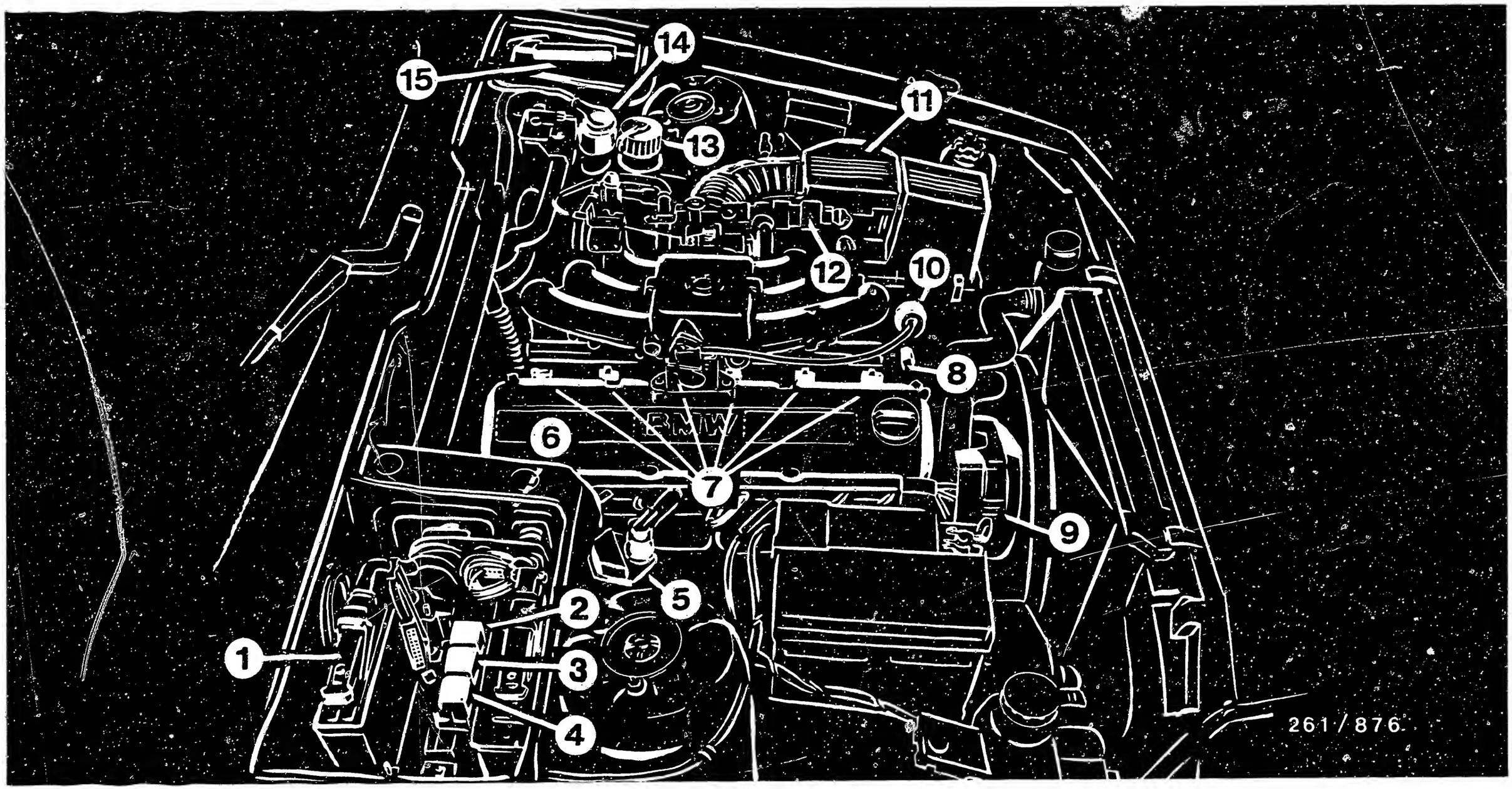


ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

A1 = Transmission control unit (for vehicles with transmission control)
B6 = Throttle-valve switch with potentiometer (for vehicles with transmission control)
H1 = "CARB" lamp (fault lamp; US version only)
P1 = Instrument cluster
P2 = Vehicle computer
S4 = Position switch (automatic transmission only)
T1 = Ignition coil
X1 = Motronic control-unit plug
X2 = Engine plug
X3 = Diagnosis socket
X4 = Jumper in cover
X5 = Plug connection to GS
R1 = Stimulation lead
R2 = Serial interface

A23 —— <⟹>

A24 —— <⟹



INSTALLATION POSITION OF COMPONENTS

1= Motronic control unit
2= Main relay (white)
3= Pump relay (orange)
4= Sensor heater relay (orange)
5= Ignition coil
6= Motronic ground terminal (beneath cover)
7= Solenoid-operated injection valves
8= Temperature sensor (engine)
9= High-voltage distributor
10= Fuel pressure regulator
11= Air-flow sensor
12= Idle actuator
13= Diagnosis socket
14= Engine plug
15= Fuse box

INSTALLATION POSITION OF COMPONENTS (continued)

The installation locations always refer to the direction of travel.

Electric fuel pump:
installed in tank; access via cover in trunk to right of spare wheel.

Fuel filter:
beneath vehicle on right, in front of fuel tank
(top picture, arrow).

Fuse no.23 for electric fuel pump:
in fuse box.

Lambda sensor (for cat.):
in joint exhaust pipe (center picture, arrow).

Plug connection for lambda sensor (round, 4-pole):
at rear left of engine block, beneath starting motor.
Installation position as in 535i (bottom picture, arrows).

Tank ventilation valve (for cat.):
beneath intake manifold.

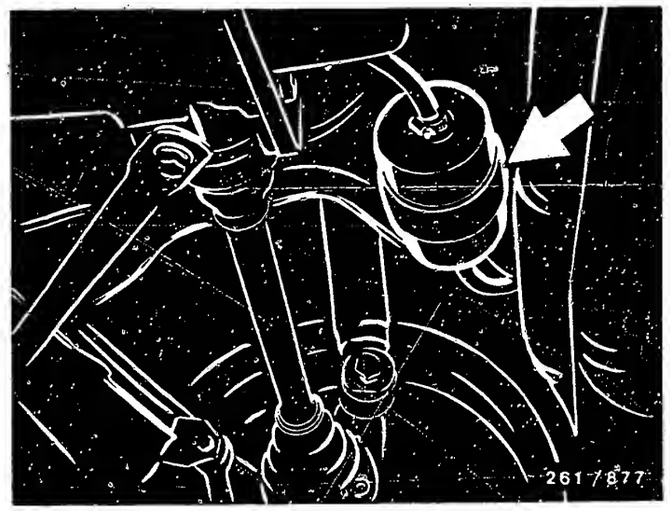
Active-carbon container (for cat.):
in front left of engine compartment.

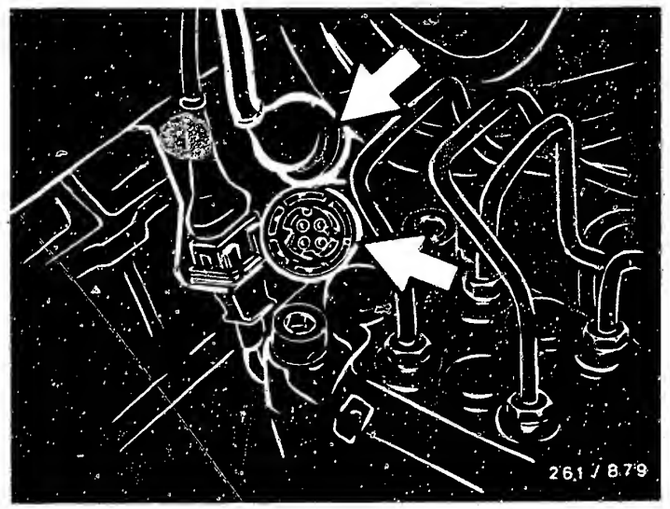
Throttle-valve switch:
at bottom of throttle-valve assembly.

Air temperature sensor:
in air-flow sensor.

Engine-speed/reference-mark sensor:
at front of engine, to right of crankshaft ring gear.

High-voltage sensor:
on high-tension ignition cable to cylinder 6.





Trouble-shooting instructions : VOL-5005

BOSCH system : LH 2.2-Jetronic

Make of vehicle : VOLVO

Basic microcard : KFZ-00..

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following vehicle models with 2.316 1/4-cyl. engine:

Volvo 740 GLE
EU, AUS, CDN, and J models with catalytic converter

* As of 5/86 control unit 0 280 000 544
  As of 5/87 control unit 0 280 000 554

* Engine-speed triggering at control unit, term. 1 by way of TN signal from term. 17 of ignition control unit.

* Lambda closed-loop control with heated sensor.

* Auxiliary relay for injection valves for radio interference suppression.

* Idle-speed regulation with double-winding rotary actuator.

* Start control, i.e. additional injected fuel quantity via all solenoid-operated injection valves.

* Connect pressure gauge with connecting element KDJE-P 100/14 to pressure-regulator supply line for testing fuel pressure.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel when testing the compression.
To ensure this, disconnect pump relay.

For further precautionary measures, see brief instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*		*		Universal test adapter
*											Electric fuel pump
*	*	*	*								Auxiliary-air device/idle actuator
*	*	*	*	*	*	*	*				Air-flow sensor/air-mass sensor
*	*	*	*		*						Intake system
		*	*	*		*	*				Solenoid-operated injection valves
*	*	*			*	*					Fuel pressure
				*	*						Fuel quantity
		*	*	*	*	*					Throttle valve
				*							Overrun cut-off
*		*									Start control
				*							Ground
*	*	*	*	*	*						Alternator, interference suppress.
		*	*	*		*					CO exhaust-gas adjustment
				*							Control unit
						*					Catalytic converter
		*	*	*	*						Lambda closed-loop control

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

Test step	Switch V	Switch Ω	Terminals	Testing of component/function	Test instructions/ Test conditions		Set values
1	| V	5	2 – 11	Temperature-sensor resistance (engine)	Only connect adapter lead to peripherals.	+15...+30°C: Approx. +80°C:	1.45...3.3 k Ω 280...360 Ω
2	| V	6	25 – 11	Ground connection of output stage			0...10 Ω
3	| V	7	5 – 11	Ground connection of sensors			0...10 Ω
4	| V	8	13 – 11	Resistance of parallel solenoid-operated injection valves	Pull auxiliary relay out of connection frame. Connect connection 3 at plug-in frame to vehicle ground.	+15...+30°C: Approx. +80°C:	5,5...8,0 Ω 5,9...8,5 Ω
5	| V	9	3 – 11	Resistance of idle contact	Detach control-unit plug from ignition control unit.	Acc. pedal not depressed: Depress acc. pedal somewhat:	0...10 Ω Infinity Ω
6	| V	10	12 – 11	Resistance of full-load contact	Control-unit plug remains detached	Acc. pedal not depressed: Completely depress acc. ped.:	Infinity Ω 0...10 Ω
7	| V	10	12 – 11	Resistance of idle-speed regulation test pin	Connect test pin to ground. After testing, connect control-unit plug to ignition control unit again.		0...10 Ω
8	| V	11	10 – 11	Resistance of idle actuator, 1st winding	Pull auxiliary relay out of plug-in frame. Connect connection 3 at plug-in frame to vehicle ground.	+15...+30°C: Approx. +80°C:	20...32 Ω 24...37 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

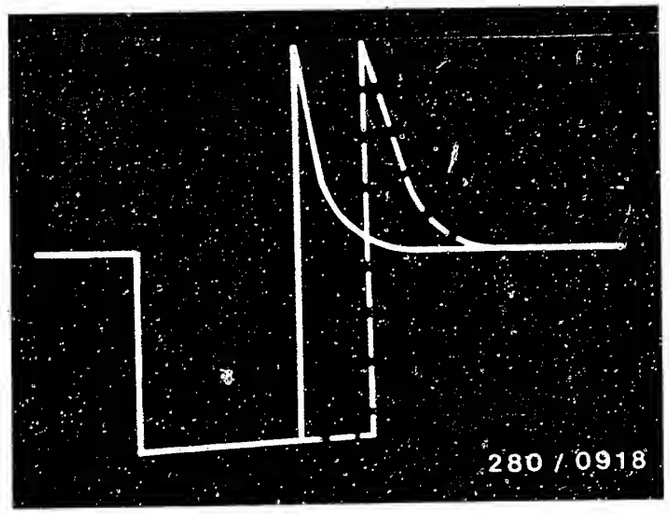
Test step	Switch V	Switch Ω	Terminals	Testing of component/function	Test instructions/ Test conditions	Set values
9	| V	12	23 – 11	Resistance of idle actuator, 2nd winding	Adapter lead remains connected to peripherals. +15...+30°C: Approx. +80°C: Pull auxiliary relay out of plug-in frame. Connect connection 3 at plug-in frame to vehicle ground.	18... 30 Ω 22... 34 Ω
10	| V	13	15 – 11	Overrun-cutoff suppression (if provided)	Engage 1st or 2nd gear: Engage 3rd or 4th gear:	0...10 Ω Infinity Ω
11	| V	21	14 – 6	Resistance of idle-mixture potentiometer	Dependent on CO adjustment	10...1100 Ω
12	5	21	1 – 11	TN speed signal from ignition control unit term. 17	Transmission in neutral, start engine	Square-wave volt. Excursion at least 80% U-Batt.
13	6	21	9 – 11 (+) (–)	Voltage, main relay, term. 87	Press button 4	8...15 V
14	7	21	18 – 11 (+) (–)	Voltage, ignition and starting switch	Ignition "ON"	8...15 V
15	8	21	21 – 11 (+) (–)	Voltage at main relay, term. 85		8...15 V
16	9	21	17 – 11 (+) (–)	Voltage at pump relay, term. 85	Press button 4	8...15 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

Test step	Switch V	Switch Ω	Terminals	Testing of component/function	Test instructions/ Test conditions	Set values
17	10	21	16 – 11	Voltage at air-conditioner switch (only if air conditioner fitted)	Connect adapter lead to periphery and control unit. Leave engine running. Switch on air conditioner.	8...15 V
18	3	21	7 – 6	Output voltage, hot-wire air-mass sensor	Leave engine running. The output voltage must change when the engine speed changes.	2...5 V
19	11	21	22 – 11	Voltage at integrator output, lambda closed-loop control (open-loop-control value)	Leave engine running until at normal operating temperature.	10...13 V
20	11	22	22 – 11	Voltage at integrator output, lambda closed-loop control (rich value)	Leave engine running until at normal operating temperature.	10...13 V
21	11	23	22 – 11	Voltage at integrator output, lambda closed-loop control (lean value)	Leave engine running until at normal operating temperature.	Less than 0.5 V
22	11	24	22 – 11	Voltage at integrator output, lambda closed-loop control (closed-loop-control value)	Leave engine running until at normal operating temperature. Conduct measurement at approx. 2500 min $^{-1}$.	0...13 V fluctuating
23	11	24		Basic idle speed	Not applicable	

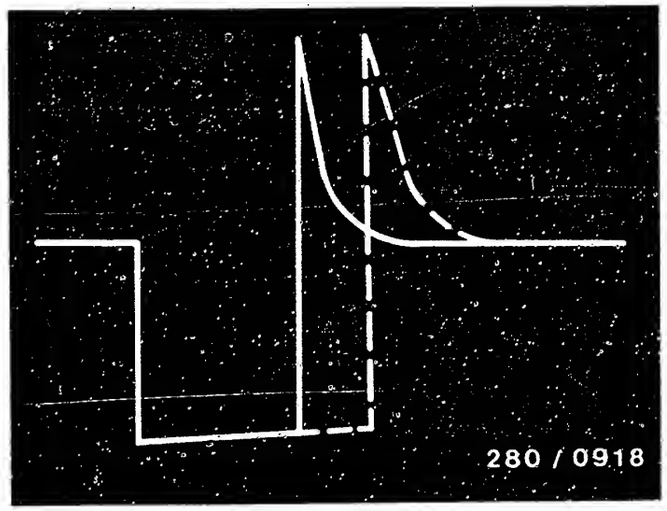
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

Test step	Switch V	Switch Ω	Terminals	Testing of components/function Test instructions/conditions	Set values
24	11	24		On/off ratio at idle actuator Measurement with dwell-angle tester at sockets 1 and 2 Apply LFR* test pin to ground : Loosen LFR test pin from ground: In addition, switch on air conditioner (if fitted) : Accelerate; above 3000 min^{-1}, on/off ratio must increase : (*LFR = Idle mixture control.)	 29...30,5 % 31... 33 % 34... 37 % > 36 %
25	12	24	13 – 11	Injection signal t_i Leave engine running (at normal operating temperature)..	See upper illustration
26	12	24	13 – 11	Injection signal t_i Temperature sensor cold Leave engine running (at normal operating temperature). Press push-button 1. Duration of injection, engine speed and CO content become greater.	See upper illustration
27	12	24	13 – 11	Injection signal t_i Temperature sensor warm Leave engine running (at normal operating temperature). Press push-button 2. Duration of injection must remain constant.	See upper illustration



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

Test step	Switch V	Switch Ω	Terminals	Testing of component/function Test instructions/conditions	Set values
28	12	24	13 – 11	Injection signal t_i Overrun cutoff Allow warm engine to run at 2000 min^{-1} . Press button 5. Injection signals cut out and cut in again at approx. 1300 min^{-1} . Engine hunts.	See top picture
29	12	24	13 – 11	Injection signal t_i Full-load enrichment Run warm engine. Press button 6. Injection time, engine speed and CO content increase.	See top picture
30	13	24	8 – 11	Hot-wire air-mass sensor Self-cleaning function Engine must run at in excess of 2000 min^{-1} and the engine temperature must be greater than + 60°C. Then ignition "off" – voltage reading after approx. 4 s.	2...5 V Reading displayed for approx. 1 s

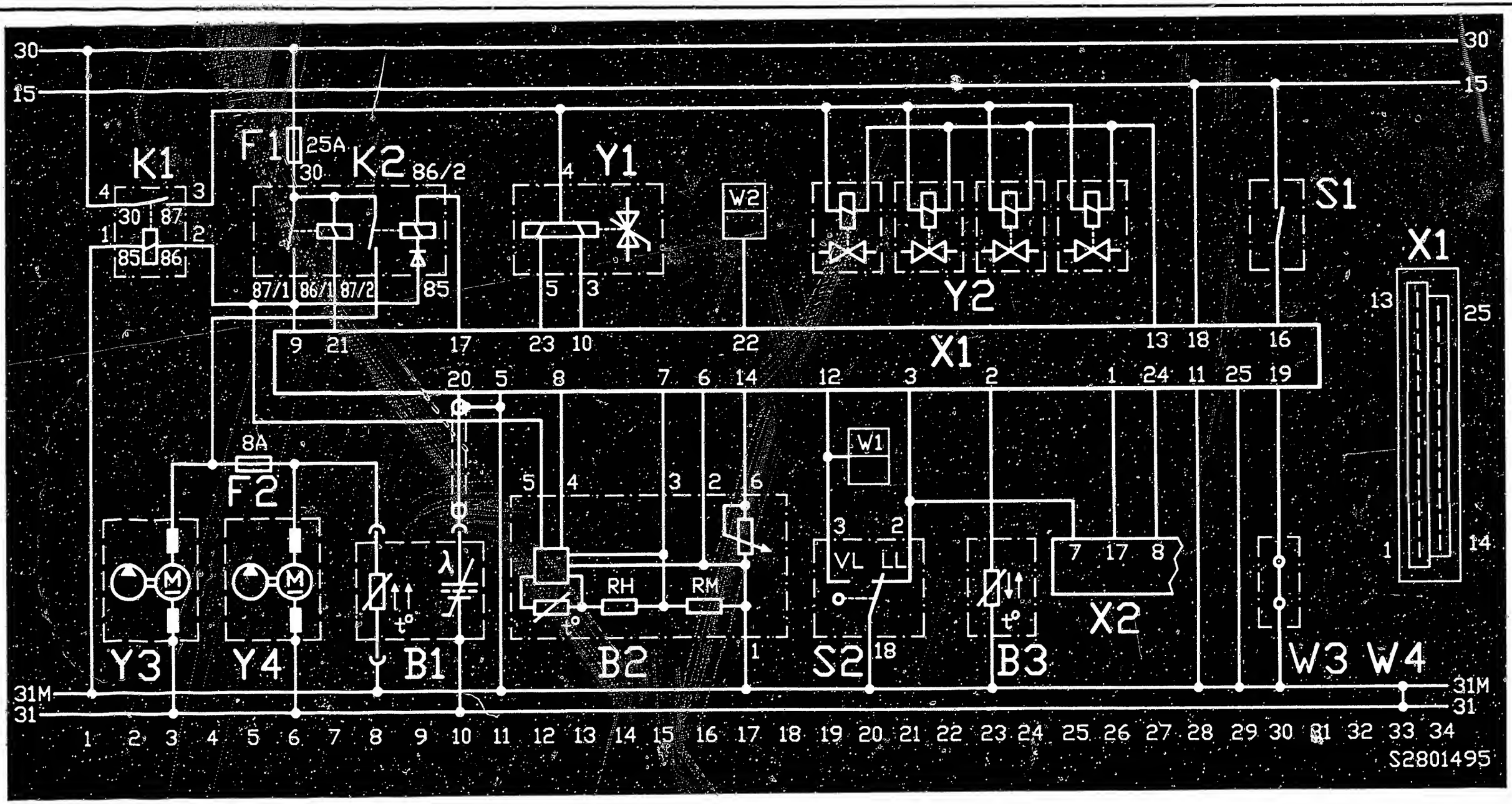


TEST SPECIFICATIONS

Component/Function	Set values
Electric fuel pump	
* Fuel delivery at return:	at least 700 cm ^{3} /30 s
* Supply voltage under load:	at least 12 V
* Fuel delivery of pre-supply pump:	at least 800 cm ^{3} /30 s
Pressure regulator	
* Fuel pressure with engine at standstill:	2,3...2,7 bar
at idle:	approx. 0.5 bar lower
Fuel system, leaks	
* Fuel pressure after 20 mins with engine at standstill:	at least 1.0 bar
Idle actuator	
* Resistance value at +15...+30°C between	
term. 4 and term. 5:	17...22,5 Ω
term. 4 and term. 3:	19...25,0 Ω
Hot-wire air-mass sensor	
* Resistance value between	
term. 6 and term. 2:	0...1100 Ω
term. 3 and term. 2:	3.6...4.1 Ω
Temperature sensor (engine)	
Double version	
* Internal electrical resistance at ambient temperature	
+15...+30°C:	1.45...3.3 k Ω
with engine at normal op.temp. approx. +80°C :	280...360 Ω

TEST SPECIFICATIONS (Continued)

Component/function	Set values
Solenoid-operated injection valve	
* Internal resistance at ambient temperature +15...+30°C:	14.5...17.5 Ω
* Leakage after 60 s:	No droplets may drip off
Start control	
* Voltage at injection valve on start initiation:	Greater than 1.5 V
after approx. 15 s:	Approx. 0.5 V
Idle-speed adjustment	
Engine at operating temperature,	approx. +80°C
* Idle speed:	730...770 min $^{-1}$
with on/off ratio:	31... 33 %
CO adjustment	Integrator voltage
Engine at op. temp. approx. 80°C	(Test pin, term. 22)
* Open-loop control (disconnect plug conn. of sensor lead):	Fixed voltage value between 10...13 V
* Closed-loop control (fit plug connection together):	Reading fluctuates between 0...13 V
* Adjustment:	Uniformly fluctuating reading between 0...13V
* Rich value (disconnect plug connection and connect control-unit lead to ground):	10...13 V
* Lean value (apply 2V to control-unit lead):	Less than approx. 1.0 V
Lambda-sensor heater	
* Internal resistance	1...15 Ω



B1 = Heated lambda sensor
B2 = Hot-wire air-mass sensor
B3 = Temperature sensor (engine)
F1 = Main/pump fuse
F2 = Sensor-heater fuse
K1 = Auxiliary relay (interference supp.)
K2 = Main/pump relay
S1 = Air-conditioning switch
S2 = Throttle-valve switch
W1 = Test pin idle-speed regulation
W2 = Test pin, integrator voltage (lambda)
W3 = TV encoding (lambda)
W4 = Engine ground strap
X1 = Control-unit plug - Jetronic
X2 = Control-unit plug - ignition
Y1 = Idle actuator
Y2 = Solenoid-operated injection valves
Y3 = Electric fuel pump
Y4 = In-tank pre-supply pump

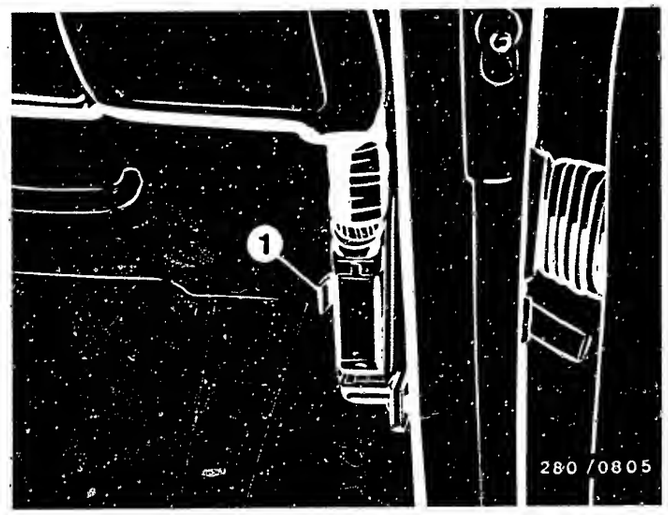
ELECTRICAL TERMINAL DIAGRAM

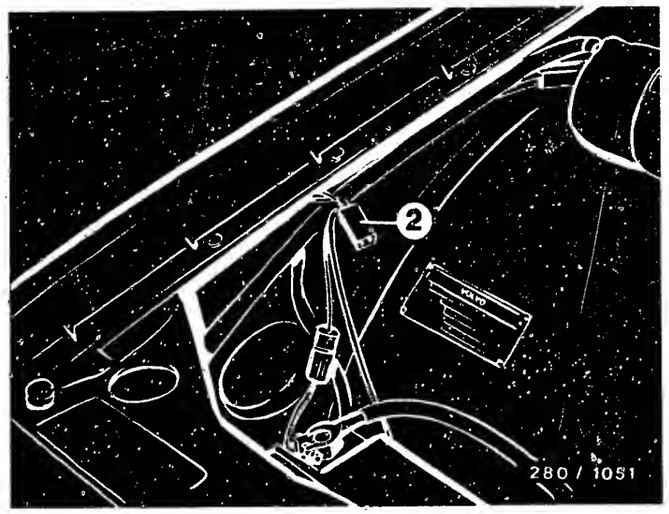
B17 — ⟹ | B18 — ⟸

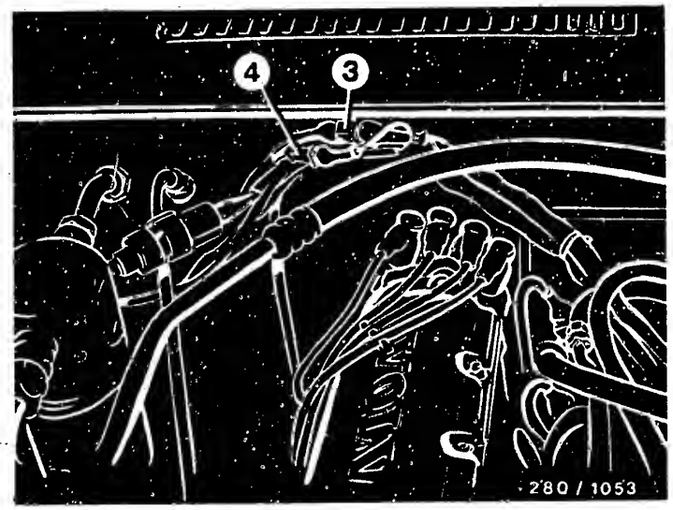
INSTALLATION POSITION OF COMPONENTS

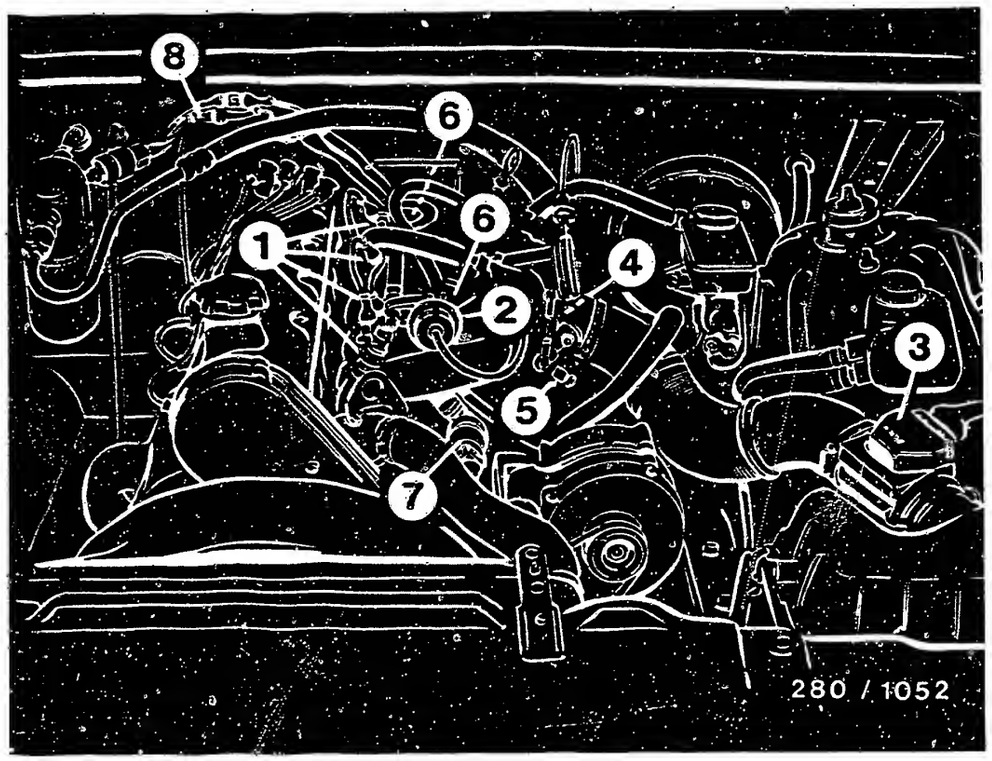
1 = Control unit
2 = Test pin (IMC- red/white) integrator output (green/white)
3 = Plug connection, lambda-sensor heater
4 = Plug connection, lambda sensor

The control unit is located on the right in the passenger-side footwell behind a cover.
The pump fuse as well as the main and pump relays are located in the passenger-compartment center console behind the ashtray.









1 = Solenoid-operated injection valves
2 = Pressure regulator
3 = Hot-wire air-mass sensor
4 = Throttle-valve switch
5 = Adjusting screw for on/off ratio (idle-speed regulation)
6 = Ground terminal
7 = Idle actuator
8 = Lambda-sensor plug connection

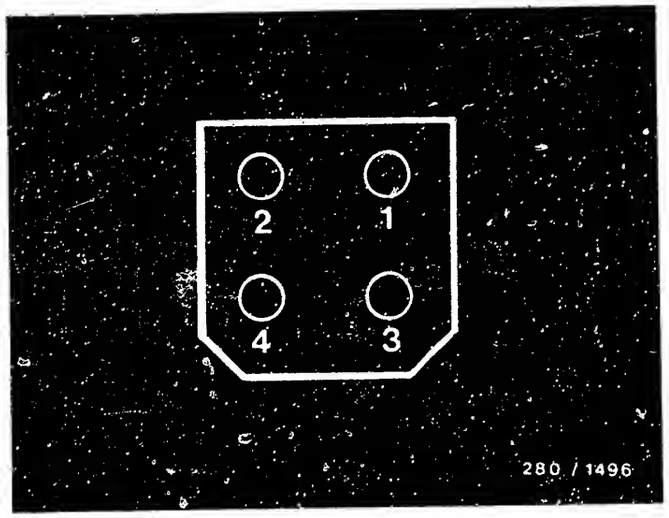
INSTALLATION POSITION OF COMPONENTS (Continued)

Temperature sensor (engine) is located between 3rd and 4th solenoid-operated injection valves beneath the intake manifold.

For production reasons:
continued on the following coordinate.

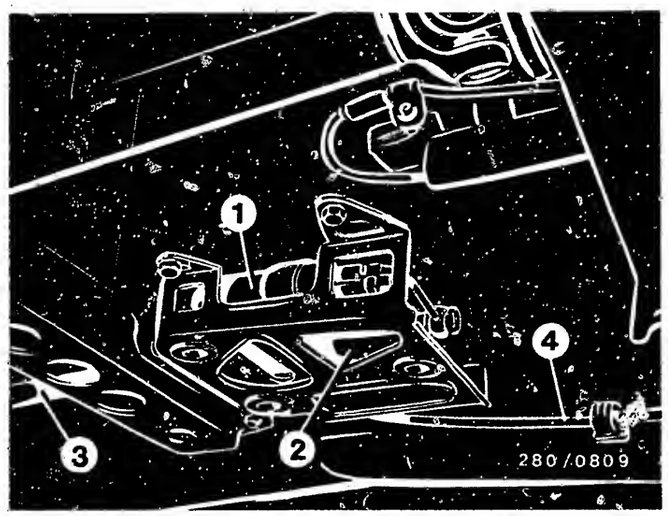
INSTALLATION POSITION OF COMPONENTS (Continued)

* Top picture
  The auxiliary relay is attached to the container for the windscreen washer system.
  The picture gives a view of the plug-in frame with terminals.



* Center picture
  1 = Electric fuel pump
  2 = Fuel filter
  3 = Fuel suction line
  4 = Fuel delivery line

Pre-supply pump in tank (accessible via trunk)

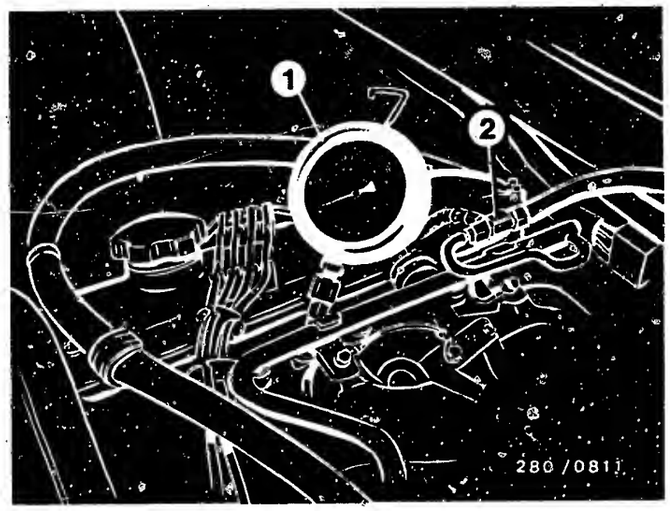


* Bottom picture
  1 = Pressure gauge
  2 = Connecting element KDJE-P 100/14

Fuel pressure test

Connect pressure gauge or pressure measuring instrument. Unscrew fuel delivery line at fuel distributor pipe.
Fit connecting element KDJE-P 100/14 in line.
Ensure leakproof connection.

IMPORTANT! Make sure no fuel gets on to hot parts of the engine when the hose is unscrewed.



Trouble-shooting instructions : AUD-5022

BOSCH system : Electronic transmission control GS 1.3

Make of vehicle : AUDI

Basic microcard : KFZ-00..

TABLE OF CONTENTS

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

* Audi V 8 with 3.6 l / 8 cyl. as of 10.88.

* Electronic transmission control GS 1.3 (55 pole) with self-diagnosis (fault memory and actuator test).

* The fault memory can be read out using the pocket system tester KTS 300 (0 684 400 300) with program module PPG 204 as of status 25.09.89.
  Note:
  Further diagnosis possibilities (actuator diagnosis etc.), which would be possible with newer program module statuses, are not evaluated for these vehicles.
  Pay attention to operating instructions for KTS 300.
  Connect KTS 300 via universal adapter lead to diagnosis connection in vehicle.

* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code.

* The self-diagnosis test table takes account of both the KTS 300 and the flashing code and is arranged according to fault code numbers indicated by the KTS 300.
  The fault indication column sometimes includes two types of fault alternately indicated by the tester, e.g.:
  Open circuit/short to ground (= 1st type of fault)
  Short to positive (= 2nd type of fault)

* Refer to basic instructions for description of how to use and how to activate self-diagnosis.

SPECIAL FEATURES (CONTINUED)

* 3 gear-shift programs (economy, sport, manual)

* An additional pressure regulating valve for actuating the so-called longitudinal lock (multi-disc clutch, hydraulically actuated).
  Task:
  The longitudinal lock divides up the drive power to the front and rear axle such that there is no excessive slip between front and rear wheels (e.g. on icy road surface).
  Information on the speed of the individual wheels is provided by the four wheel speed sensors by way of the ABS control unit.

* AC disconnection
  Function:
  The A/C is switched off for a brief period via an output of the transmission control unit in the event of high power requirements being made on the engine, for example when accelerating powerfully and after shifting down a gear.

* Cruise control regulation
  Function:
  The voltage supply of the cruise control is regulated by the transmission electronics, so as to deactivate the cruise control under certain operating conditions such as emergency running or undervoltage.

* Safety switch
  Task:
  Avoidance of discrepancy between hydraulic and electrical position of drive position switch (adjustment).

SPECIAL FEATURES (CONTINUED)

* Fault indication
  The instrument panel contains a selector-lever position display.
  It indicates the position of the selector lever and serves at the same time as a fault indicator and flashing-code lamp.
  Faults affecting vehicle handling are indicated on the selector-lever position display. An illuminated display (both with ignition switched on and with engine running) is an indication of a static fault, i.e. a fault present at that point in time, and the limp-home program.

* Emergency operation
  If an important sensor, such as the output speed sensor, fails when driving or if the control unit isn't working, it is possible to carry on driving in 3rd gear (limp-home gear).
  Exception:
  Should this situation occur when driving in 4th gear (driving position D), 4th gear is retained until re-starting is effected.
  Otherwise the engine could be overrevved by automatic 4/3 shiftdown in the event of a fault.

* Actuator test
  The actuator test makes it possible to actively check several outputs of the transmission control unit and the components connected to it including the leads.
  The following transmission components are then actuated periodically with the engine stopped:
  1. Switching valve MV 1 (solenoid valve 1)
  2. Switching valve MV 2 (solenoid valve 2)
  3. Switching valve WK (solenoid valve, converter)
  4. Pressure regulator - modulation pressure (DRP)
  5. Pressure regulator - longitudinal lock (DRLS)
  6. Cruise control relay
  7. Output for A/C disconnection
  8. Transmission relay (positive supply for solenoid valves and pressure regulators)

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Transmission oil:

  With automatic transmissions, even slight deviations from the specified oil level or incorrect grade of oil can lead to a noticeable deterioration in the quality of shifting. Major deviations may even result in incorrect shifting.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Fault indication (selector-lever position display lit up brightly; emergency operation)	2. Engine won't start.	3. Engine cuts out in driving position.	4. No or faulty shift function.	5. Shift transitions not O.K.	6. No full-load shifting	7. Full-load shifting only	8. Manual shiftdown not O.K.	9. Harsh impact when engaging reverse gear	10. Not possible to shift into reverse	11. 4WD malfunction (longitudinal lock)	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*			*	*							Throttle-valve sensor
*	*		*	*							Position switch
*			*	*			*				Program switch
*											Safety switch
*			*								Ground-terminal open circuit or contact resistance
*											Plug on transmission dropped off or defective
*											Voltage at trans. control unit
*			*	*							Switching valve MV1, MV2 or MVWK
*				*				*			Pressure reg. - modulation press.
*										*	Pressure reg. - longitudinal lock
*			*								Output-speed sensor
*											No Tr signal
*											No engine engagement
										*	Wheel speed sensor (4)
										*	Brake switch
					*						No kick-down contact
						*					Kick-down constantly grounded
		*									No converter release
				*							Interference
										*	ABS control unit defective
*			*	*	*	*	*	*	*	*	Trans. control unit defective

SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Data exchange not possible			Prerequisite for fault output: lead to diagnosis plug/fault lamp (selector-lever position display) and power supply for control unit O.K.	15 (L) 51 (K) 31	——
Solenoid valve 1 Op.circ/Ground short Short to B+	0102	1113	Depending on fault indication, check switching valve MV1 and actuation lead* for open circuit (Op.circ), short to ground (Ground short) or short to positive (short to B+) (e.g. short-circuit with live lead due to abrasion). Resistance of solenoid-valve winding:	05 (-) 19 (+)	22...60 Ω
Solenoid valve 2 Op.circ/Ground short Short to B+	0104	1121	Depending on fault indication, check switching valve MV2 and actuation lead* for open circuit (Op.circ), short to ground (Ground short) or short to positive (Short to B+) (e.g. short-circuit with live lead due to abrasion). Resistance of solenoid-valve winding:	24 (-) 19 (+)	22...60 Ω
Solenoid valve Converter clutch Op.circ/Ground short Short to B+	0106	1123	Depending on fault indication, check switching valve for converter clutch and actuation lead* for open circuit (Op.circ), short to ground (Ground short) or short to positive (Short to B+) (e.g. short-circuit with live lead due to abrasion). Resistance of solenoid-valve winding:	42 (-) 19 (+)	22...60 Ω
Solenoid valve Pressure regulator Op.circ/Ground short Short to B+	0108	1131	Depending on fault indication, check pressure regulator for modulation pressure and actuation lead* for open circuit (Op. circ), short to ground (Ground short) or short to positive (Short to B+) (e.g. short-circuit with live lead due to abrasion). Resistance of pressure-regulator winding:	06 (-) 19 (+)	4...11 Ω

*) Actuation leads of solenoid valves, pressure regulators and output-speed sensor run between 55-pole control-unit plug and 8-pole pin terminal at transmission.

C07 —— ⟹

C08 —— ⟺

SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Solenoid valve Press.reg./long.lock Op.circ/Ground short Short to B+	010A	1133	Depending on fault indication, check pressure regulator for longitudinal lock and actuation lead* for open circuit (Op.circ), short to ground (Ground short) or short to positive (Short to B+) (e.g. short-circuit with live lead due to abrasion). Resistance of pressure-regulator winding:	25 (-) 19 (+)	 4... 11 Ω
Power take-off speed sensor incorrect/no signal	0119	1231	Open circuit in lead* or short circuit or power-take-off speed sensor (in transmission) defective. Measure resistance of power-take-off speed sensor: Note: Check insulation resistance of screening lead (term. 20) with respect to term. 02 and term. 38:	02 (+) 38 (-) 20 (A)'	 0,6...1,6 k Ω greater than 1 M Ω
Engine-speed sensor front left incorrect/no signal	011B	1233	Possible causes of trouble: 1.Open circuit in lead or short circuit in lead connection between transmission and ABS control unit. 2.Wheel-speed sensor defective (check as per ABS-SIS). 3.ABS control unit defective (renew if no fault in lead and wheel-speed sensor). Check resistance between TC control-unit plug (term. 11) and ABS control-unit plug (term. 17):	11	 approx. 0 Ω
Engine-speed sensor front right incorrect/no signal	011D	1241	Possible causes of trouble as with fault code 011B. Check resistance between TC control-unit plug (term. 30) and ABS control-unit plug (term. 23):	30	 approx. 0 Ω

*) Actuation leads of solenoid valves, pressure regulators and power-take-off speed sensor run between 55-pole control-unit plug and 8-pole pin terminal at transmission.
') A = Screen

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Engine-speed sensor rear right incorrect/no signal	011F	1243	Possible causes of trouble as for fault code 011B. Check resistance between TC control-unit plug (term. 48) and ABS control-unit plug (term. 30):	48	 approx. 0 Ω
Engine-speed sensor rear left incorrect/no signal	0122	1311	Possible causes of trouble as for fault code 011B. Check resistance between TC control-unit plug (term. 12) and ABS control-unit plug (term. 31):	12	 approx. 0 Ω
Position switch defective	0125	1314	1.Check leads of position switch (S1, S2, S3) for open circuit, short to ground or short to positive. Watch out for worn insulation. 2.Position switch incorrectly adjusted.	50, 14 33	see "Test specifications" Coordinate 19
Kickdown switch Short to ground	0128	1323	Use ohmmeter to check switch and lead to control unit for short to ground. Kickdown switch closed in full-throttle position: Release accelerator pedal somewhat:	41	 approx. 0 Ω (continuity) infinity Ω (no continuity)
Program-selector switch Short to ground	012B	1332	Check program-selector-switch leads (E, M) for open circuit and short to ground. Watch out for worn insulation! Check program-selector switch (resistance measurement with respect to vehicle ground): 1.Switch in position "E": term. 29 of GS* connected to vehicle ground, term. 10 open: 2.Switch in position "M": term. 10 of GS* connected to vehicle ground, term. 29 open: 3.Switch in position "S": term. 29 and term. 10 of GS* open:	29 10	—— term. 29: approx. 0 Ω term. 10: infinity Ω term. 10: approx. 0 Ω term. 29: infinity Ω term. 29: infinity Ω term. 10: infinity Ω

* = Transmission control unit

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Throttle-valve signal Signal too low	0206	2212	Possible causes of trouble: 1. Open circuit or short to ground in wiper lead (GS*-term. 08). Watch out for worn insulation! 2. Throttle-valve potentiometer defective. 3. GS* defective. Test with ohmmeter at term. 27 with respect to term. 44 in open control-unit plug: Note: There must be continuity (approx. 0 Ω) between term. 27 and term. 45. Resistance at term. 08 with respect to term. 44 with throttle valve closed: Accelerate slowly:	27 (+) 44 (-) 08 (S)*	 1,5...2,5 k Ω 45...175 Ω resistance increases without dips.
Brake switch Op.circ./Sh. to B+	020E	2131	Possible causes of trouble: 1. Fuse No. 03 (25A) defective. 2. Stop-lamp switch or brake switch for GRA* defective. 3. Check lead between stop-lamp switch, brake-pedal switch for GRA* and GS* (term. 04) for open circuit and short to positive. Test with voltmeter at term. 04 in open control-unit plug with respect to vehicle ground: Brake not actuated: Brake depressed:	04	 approx. 0 V battery voltage
Engine speed signal incorrect/no signal	0211	2122	Fault: Incorrect/no Tr-signal from Motronic. Possible causes: 1. Open circuit, short to ground or short to positive in lead between transmission (term. 03) and Motronic control unit (term. 03). 2. Fuel-pump relay defective (short to positive or short to ground in winding); renew. 3. Motronic or GS control unit defective. Check signal with oscilloscope with engine running at term. 3 with respect to term. 7 in open transmission control-unit plug or at term. 85 of fuel-pump relay:	03	 needle pulses

*) S = Wiper GS = Transmission control unit GRA = Cruise control

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Battery voltage too low	0214	2234	If the voltage supply for the transmission control unit is below 9 V, then this is recognized as being a fault. Trouble-shooting: 1. Check vehicle voltage with engine running (battery charge, alternator): 2. Switch off ignition, detach transmission control unit and consecutively measure voltage in detached control-unit plug at term. 01 and term. 17 with respect to term. 07 (let engine run): If set value is not attained, check lead routing in accordance with connection diagram (fuses, contact resistances, breaks in cables, worn insulation).	01 (+) 17 (+) 07 (-)	 min. 12 V min. 12 V
Throttle poten. voltage too high too low	021A	2241	Check voltage between term. 45 and term. 07 as well as between term. 27 and term. 07 in control-unit plug both with ignition switched on and with engine running: If set value is not attained, check leads for open circuits and short circuits in accordance with circuit diagram.	45 (+) 27 (+) 07 (-)	 4.5...5.5 V in each case
Spk.-advance ang. intervention interf. Op.circ/Ground short Short to B+	0221	2314	Fault: No or permanent spark-advance-angle intervention. Possible causes: 1. Open circuit (Op.circ), short to ground (Ground short) or short to positive (Short to B+) (e.g. due to worn insulation) in lead between transmission control unit term. 32 and Motronic control unit term. 51. 2. Motronic control unit defective (interrogate Motronic fault memory). 3. Transmission control unit defective (renew).	24	Negative rectangular pulse (on shifting gear)

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flashing code	Test instructions/Test conditions	Terminals	Set values
Fuel-consumption signal Short to B+ Op.circ/Ground short	0225	2243	Fault: Incorrect or no ti signal from Motronic. Detach transmission control unit (with ignition switched off) and check signal with engine running in transmission control-unit plug term. 21 with oscilloscope: If no signal present, check lead between transmission control unit term. 21 and Motronic term. 32 for open circuit (Op.circ), short to ground (Ground short) and short to positive (Short to B+). Renew Motronic control unit if lead is O.K.	11	Fuel-injection signal
Safety switch Short to ground Op.circ./Sh. to B+	0315	3221	Note: The driving position switch is also always to be tested (see basic instructions) if this fault is indicated. Check function of safety switch: To do so, check continuity in transmission control plug between term. 40 and term. 07 (ground) with ohmmeter: Selector lever in pos. R, P : Selector lever in pos. 1, 2, 3, D : If set values are not attained, check lead to safety switch for open circuit (Op.circ.), short to ground and short to positive (Sh. to B+). Watch out for worn insulation! Renew safety switch if lead is O.K.	40	infinity Ω approx. 0 Ω
Control unit Digital sec.(comput) defective	FFFF	1111	Possible causes of trouble: 1. 8-pole pin terminal at transmission dropped off. 2. Transmission control unit defective.	—	—
No fault stored	FFFF	4444	Continue trouble-shooting with trouble-shooting chart.	—	—
		0000	End of output (flashing code only)	—	—

TEST SPECIFICATIONS

The stated test specifications apply to measurements directly at the component or at the 55-pole plug.

Output-speed sensor: 0,6...1,6 k Ω

Pressure regulators for modulation pressure and longitudinal lock: 4... 11 Ω

Switching valve MV1, switching valve MV2 and converter switching valve
Each: 22... 60 Ω

Kickdown switch actuated: approx. 0 Ω

Selector lever in position:

	1	2	3	D	N	R	P	ZW
Term.50	0	UB	0	0	UB	UB	UB	0
Term.14	UB	0	0	UB	UB	0	UB	0
Term.33	0	UB	UB	UB	0	0	UB	0

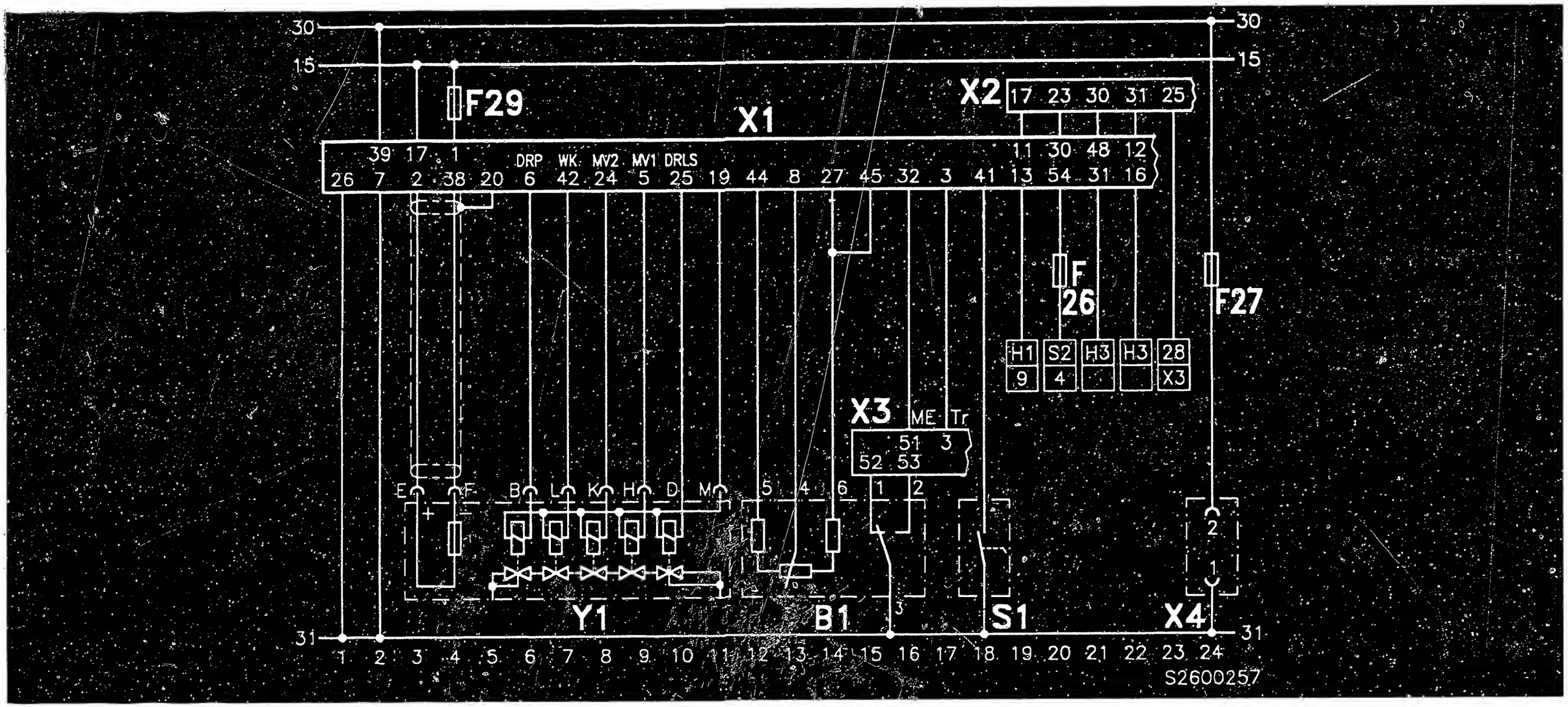
ZW = Intermediate position
UB = Battery voltage (switch on ignition)

Throttle-valve potentiometer:

Total resistance between pin 6 (term. 27 and 45) and pin 5 (term. 44): 1,5...2,5 k Ω

Wiper resistance between pin 4 (term. 8) and pin 5 (potentiometer on idle stop): 45...175 Ω

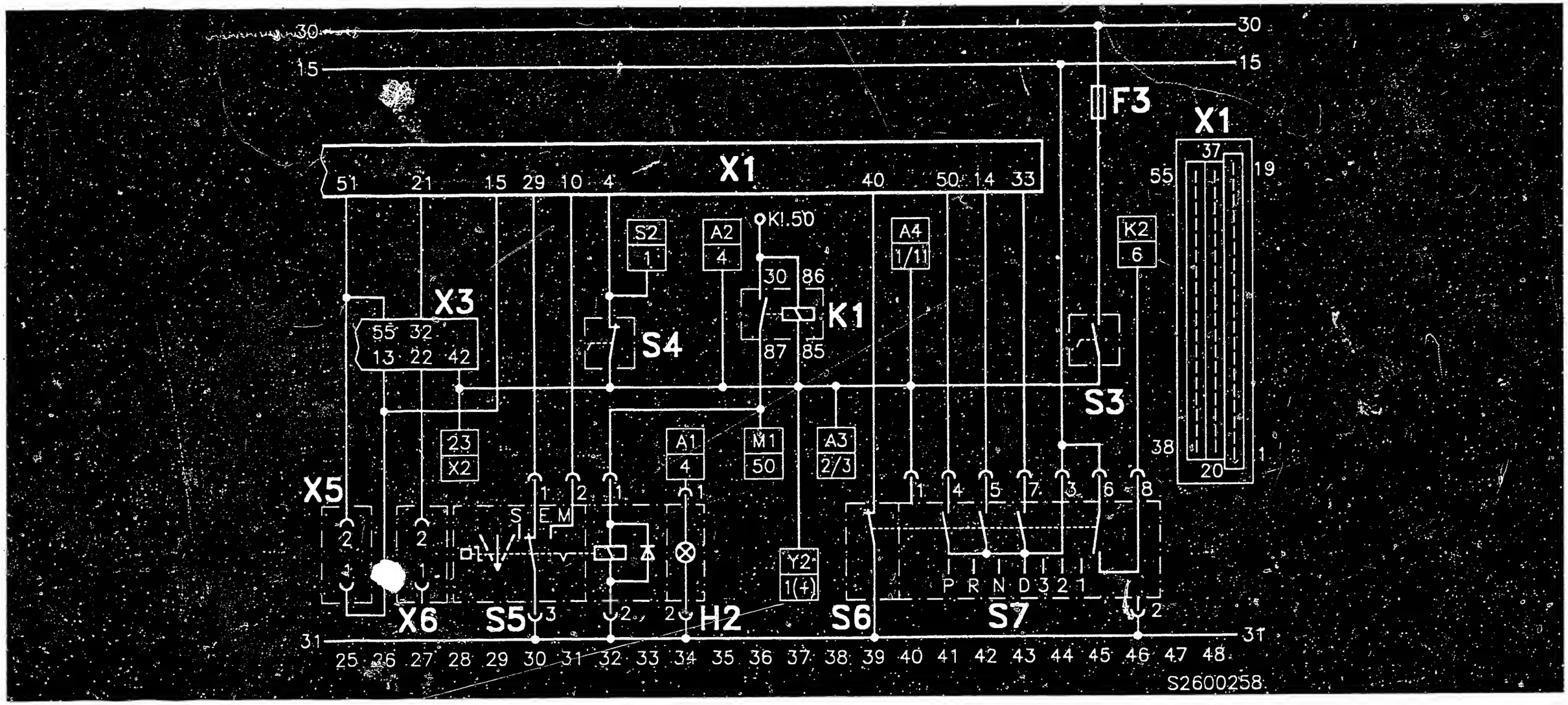
For production reasons:
continued on the following coordinate.



ELECTRICAL TERMINAL DIAGRAM

B1 =Throttle-valve sensor
F26=Individ. fuse for cruise control (5A)
F27=Fuse to battery positive
F29=Individ. fuse for trans. control (10A)
H1 =Control/indicator unit for A/C
H3 =Gear and program indicator
S1 =Kickdown switch
S2 =Switch for cruise control
X1 =Transmission control-unit plug
X2 =ABS control-unit plug
X3 =Motronic control-unit plug
ME: Engine intervention
Tr: Engine speed info
X4 =Diagnosis plug 1
Y1 =Transmission control section (8-pole pin terminal at transmission):
E/F: Output-speed sensor
B: Pressure regulator - modulation pressure (DRP)
L: Switching valve - converter (WK)
K: Switching valve MV2
H: Switching valve MV1
M: Positive supply for all solenoid valves
D: Pressure regulator - longitudinal lock (DRLS)

C21 — ⟹
C22 — ⟺



ELECTRICAL TERMINAL DIAGRAM (continued)

A1 =Amplifier for interior lighting
A2 =Control unit for selector-lever lock
A3 =Rear lamp monitoring unit
A4 =Control unit for car alarm
F3 =Fuse in fuse holder/relay plate
H2 =Program switch illumination
K1 =Relay for AT transmission
K2 =Relay for backup lamp
M1 =Starting motor
S2 =Switch for cruise control
S3 =Stop-lamp switch
S4 =Brake-pedal switch for cruise control
S5 =Program switch
S6 =Safety switch (and backup lamps)
S7 =Position switch
X1 =Transmission control-unit plug
X3 =Motronic control-unit plug
X5 =Diagnosis plug 2
X6 =Diagnosis plug 4
Y2 =Solenoid for selector-lever lock

INSTALLATION POSITION OF COMPONENTS

Diagnosis plug:
Four 2-pole plugs at relay holder in passenger-side footwell (remove carpet). Refer to basic instructions.

Control unit for electronic transmission control:
Beneath dash panel insert together with Motronic control unit (item 1) on joint holder (top picture).

R e m o v a l :

* Unscrew cover beneath dash panel insert (footwell, left)

* Remove heating duct for footwell, left

* Unclip footwell light and push through opening

* Remove holder for Motronic and transmission control unit (arrows)

* Unscrew transmission control unit (lower control unit; item 2)

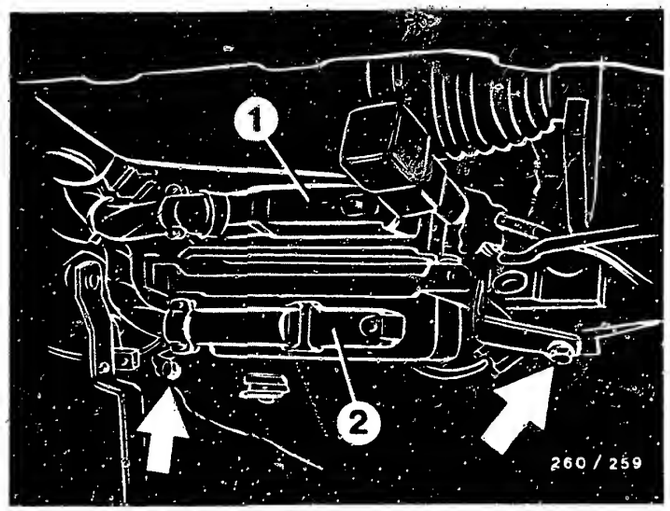
Output-speed sensor, switching valves, pressure regulators:
In transmission (control section)

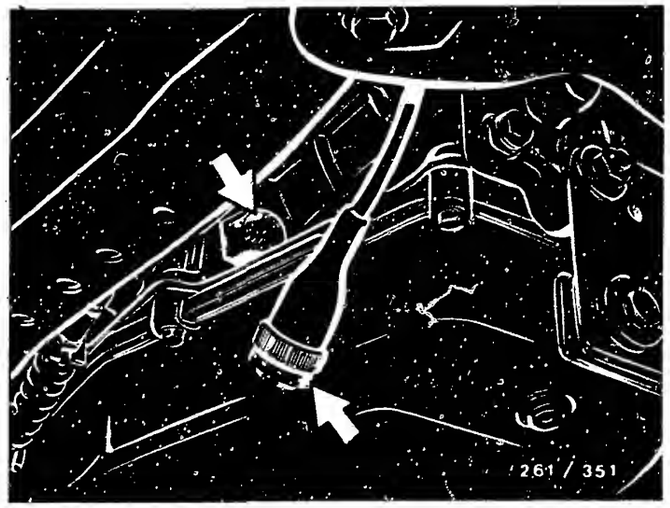
Connectors (round, 8-pole) for output-speed sensor, switching valves and pressure regulators:
On transmission (center picture; arrows)

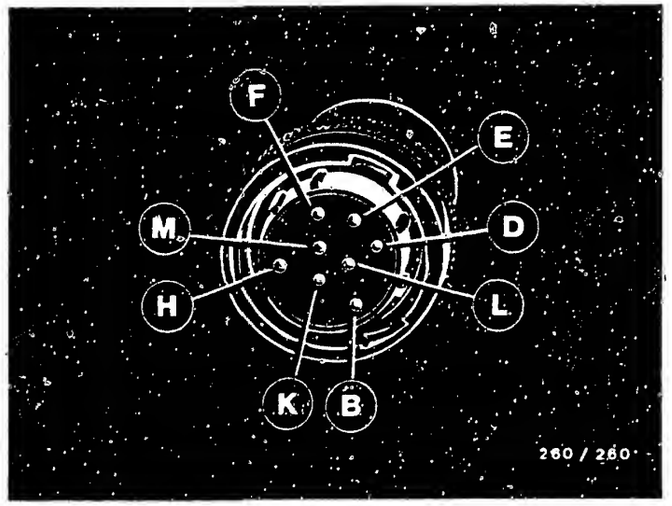
Refer to bottom picture for plug assignment:

B: Pressure regulator - modulation pressure
D: Pressure regulator - longitudinal lock
E/F: Output-speed sensor
H: Switching valve MV1
K: Switching valve MV2
L: Switching valve - converter
M: Positive supply for solenoid valves

Kickdown switch:
Beneath accelerator pedal







INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Selector lever:
On control console (top picture, item 1).

Program switch:
On control console (top picture, item 2).

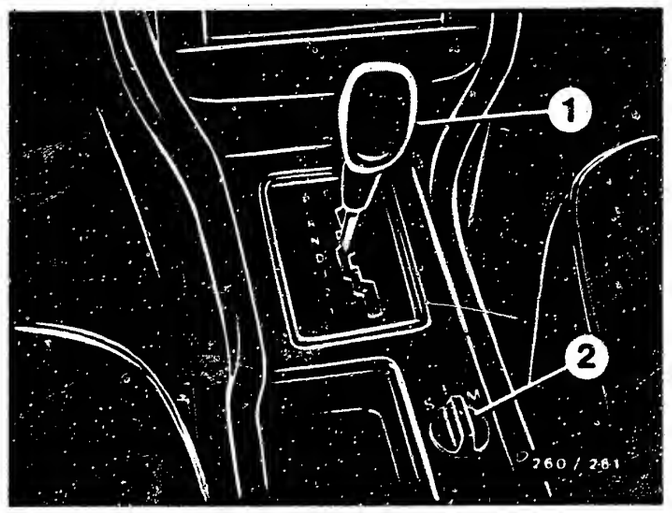
Position switch (actuated by way of selector lever):
On side of transmission (center picture).

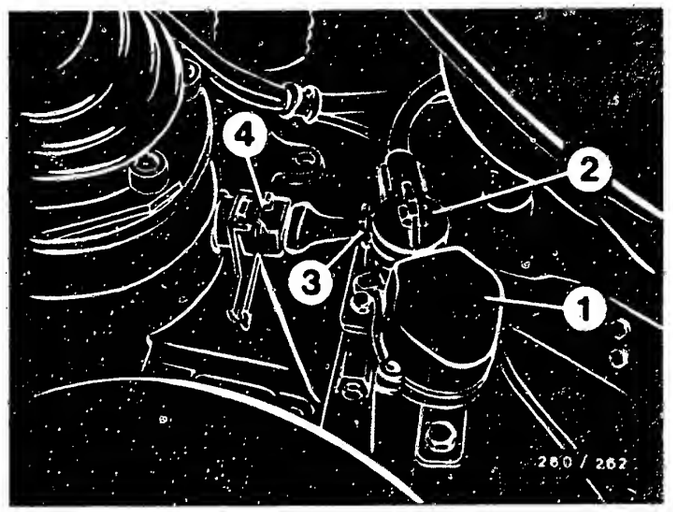
Item 1: Position switch
Item 2: 8-pole connector for position switch
Item 3: Interlock for 8-pole connector
(pull down)
Item 4: Connector on speed sensor
(not for transmission control)

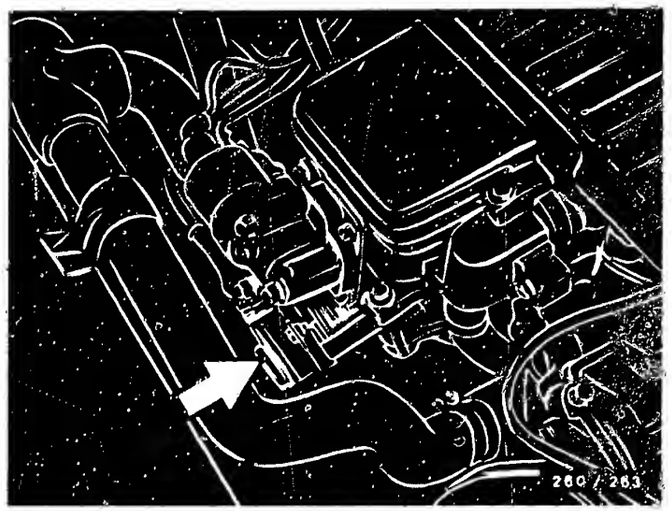
Throttle-valve potentiometer:
On side of throttle-valve assembly (throttle-valve stem)
(bottom picture, arrow).

N o t e :

Setting is effected by way of idle contact (term. 1/3), then check voltage at connected plug (push back rubber sleeve) between term. 4 and term. 5 - switch on ignition;
Accelerator pedal in off-position: approx. 0.2...0.3 V
Accelerator pedal depressed: greater than 3.5 V







Trouble-shooting instructions : OPE-5020

BOSCH system : Motronic ML 4.1

Make of vehicle : OPEL

Basic microcard : PKW-050

TABLE OF CONTENTS

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

* OPEL Vectra (9.88 ->),
Vectra 4X4 (2.89 ->)
with and without catalytic converter,
Engine: 2.0 l / 4-cylinder,
Engine type OHC, C 20 NE, C 20 NEF,
20 NE, 20 SEH

* Motronic ML 4.1 with self-diagnosis and 35-pole control-unit plug.

* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 09.01.89.

Note:
Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.

Pay attention to operating instructions for KTS 300. Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 465 187 (Opel).

* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units).

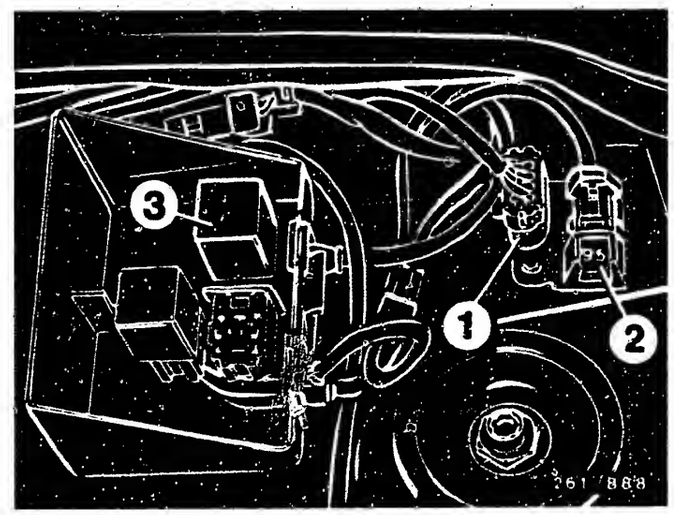
* One joint sensor for engine speed and reference mark

* Single-winding rotary actuator

* Variant encoding for octane-number adjustment and transmission

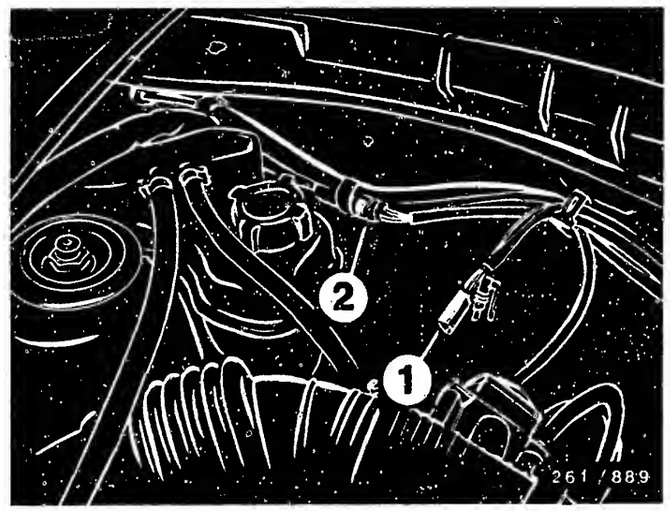
Variant encoding

Octane number	Resistance at term. 15 2 l engine, low compression (9.2) without catalytic converter (fact. encoding 98 RON)	 with regulated catalytic converter (fact. encoding 95 RON)	 2 l engine, high compression (10), w/o catalytic converter (fact. encoding 98 RON)
91 RON	0 Ω 1)	0 Ω 1)	—
	infinity Ω 2)	infinity Ω 2)	—
	—	750 Ω 2)3)5)	—
95 RON	220 Ω 1)	220 Ω 1)	220 Ω 1)
	1200 Ω 3)4)	1200 Ω 3)	1200 Ω 3)4)
	2200 Ω 2)	2200 Ω 2)	2200 Ω 2)
	4700 Ω 2)3)4)	4700 Ω 2)3)	4700 Ω 2)3)4)
	750 Ω 2)3)4)5)	—	infinity Ω 2)3)4)5)
98 RON	470 Ω 1)	—	470 Ω 1) 750 Ω 2)



1 = Diagnosis plug
2 = Octane–number encoding plug (term. 15)
3 = Motronic relay

91 RON = Regular gasoline, unleaded or leaded for vehicles without catalytic converter
95 RON = Premium unleaded gasoline
98 RON = Premium leaded gasoline
1) Basic value
2) Idle speed is increased by 100 min $^{-1}$.
3) Acceleration enrichment is enriched.
4) Mixture is enriched: Lambda +5% correspond to approx. 1% CO.
5) Ignition timing = –5.25 °CS (retarded) over entire map range.



1 = Encoding plug for term. 27
2 = Plug–in connection for lambda sensor

Vehicles with catalytic converter:
term. 27 infinity Ω (open)
Vehicles without catalytic converter:
term..27 zero Ω (to ground)
Vehicles with manually shifted transmission:
term. 10 infinity Ω (open)
term. 28 zero Ω (to ground)

Vehicles with automatic transmission:
term. 10 zero Ω (to ground)
term. 28 to selection-lever positions P and N: zero Ω (via selection lever to ground). In this way, idle speed is dropped in order to prevent driving off. In all other selection-lever positions, term. 28 is open (0 Ω)

* Adaptive lambda closed-loop control.
Note:
If engine won't start after replacing lambda sensor or injection valves or following elimination of leaks in exhaust etc., briefly detach Motronic control-unit plug with ignition switched off. The adaption values are thus cancelled. Attempt to start again.

On official vehicles (C20 NEF) the full-load function is deactivated and the power reduced. Lead to full-load contact interrupted. Note when testing. An orifice is additionally installed in the intake manifold.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

Avoid fuel injection and high-tension flashover when testing compression!
Motronic relay is therefore to be disconnected.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*											Voltage at control unit
*											Sensor
*		*			*	*					Fuel pressure
*		*				*	*				Solenoid-operated injection valves
		*	*								Idle contact
					*						Full-load contact
	*	*	*	*	*	*					Air-flow sensor
	*	*	*								Idle actuator
*	*	*	*								Air-induction system
		*									Idle speed
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
		*									Exhaust gas
		*									Overrun cut-off
		*	*	*							Interference-suppression resistors
		*	*	*							Noise test
					*						Interference

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (symptoms of trouble)

1. Starting motor operates but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring. (ignition, injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
				*						*	Throttle valve
				*							Fuel delivery
	*	*	*								Air bleed of tank
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*		*	*	*	Control unit

SELF–DIAGNOSIS TEST TABLE

Pocket System Tester Fault indication	Fault code	Flash–ing code	Test instructions / Test conditions	Term.	Set values
Data exchange not possible			Ignition on: Fault lamp lights up. Prerequisite for fault output: Leads to diagnosis plug/fault lamp and power supply to control unit including term. 18 O.K. Leads and power supply O.K., however no fault output: control unit defective.	4, 12, 17, 18	—
Lambda sensor Open circuit	13	1 3	Open circuit in lead to lambda sensor. Sensor defective.	24	—
Engine temp. sensor Short to ground	14	1 4	Test temperature sensor and lead for short to ground.	13	—
Engine temp. sensor Op. circ./sh. to B+	15	1 5	Check temperature sensor and leads for open circuit (op. circ.) and short to positive (short to B+) Temperature–sensor resistance : at +15...+30°C : at approx. +80°C :	13, ground	 1450...3300 Ω 280....360 Ω
Lambda sensor Short to ground	44	4 4	Check lead for short to ground. Watch out for worn insulation! Severe leaning, e.g. tank emptied. Leak in exhaust between engine and lambda sensor.	24	—
Lambda sensor Short to B+	45	4 5	Check lead for short to positive (short to B+) Watch out for worn cable insulation! Mixture too rich.	24	—
Battery voltage too low	48	4 8	Supply voltage for control unit too low (with engine running): Check voltage dips at positive and ground terminal. Charge battery. Check alternator system.	35(+), 5(–)	greater than 10 V
Battery voltage too high	49	4 9	Supply voltage for control unit too high (with engine running): Check alternator regulator.	35(+), 5(–)	less than 16 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket System Tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Term.	Set values
Control unit Digital sec.(comput) defective	51 or 55	5 1 or 5 5	Control unit defective.	—	—
CO potentiometer Signal too low	1) 65	1) 6 5	Measure resistance of CO potentiometer (idle potentiometer) : Check lead for short to ground. Term. 3 open circuit. Term. 3 and term. 4 jumpered.	30	Measure resistance at air-flow sensor between term. 1 and term. 4: Minimum 0...30 Ω Maximum: The value measured between term. 3 and term. 4 may be up to 30 Ω less. (Set value between term. 3 and term. 4:300..550 Ω)
CO potentiometer Signal too high	1) 66	1) 6 6	Measure resistance of CO potentiometer (idle potentiometer): Test potentiometer and leads for open circuit and short to positive. Fault code 7 4 is also indicated in the event of term. 4 open circuit.	30	
Idle switch Short to ground	67	6 7	Fault: Idle contact (in throttle-valve switch or sensor) permanently closed or lead short to ground. Idle contact closed in off position : Actuate throttle valve somewhat : In the event of increased idling speed or "hunting" idle actuator or control unit defective.	2, ground	approx.0 Ω infinity Ω
Air-temp. sensor Short to ground	69	6 9	Check temperature sensor and lead for short to ground.	22	—
Air-temp. sensor Open circuit	71	7 1	Check temperature sensor and leads for open circuit. Temperature-sensor resistance : at +15°C...+30°C:	22, 6(-)	1450...3300 Ω

1) Potentiometer has no effect on CO in vehicles with cat.

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket System Tester Fault indication	Fault code	Flashing code	Test instructions / Test conditions	Term.	Set values
Full-load switch Short to ground	72	7 2	Fault: Full-load contact (in throttle-valve switch or sensor) permanently closed. Fault lamp only lights up sporadically during overrun. Full-load contact closed in full-throttle position: Release accelerator pedal somewhat:	3	approx. 0 Ω infinity Ω
Air-flow sensor/ Air-mass sensor Signal too low	73	7 3	Check: Lead to air-flow sensor term. 2 for short to ground, leads to term. 2 and term. 3 for open circuit, leads to term. 3 and term. 4 for mutual contact. Air-flow sensor defective.	6(-), 7, 9(+)	———
Air-flow sensor/ Air-mass sensor Signal too high	74	7 4	Check: Lead to air-flow sensor term. 4 for open circuit (note: fault code 66 also appears), leads to term. 2 and term. 4 for short to positive (5V or B+). Check resistances of air-flow sensor : between term. 2 and term. 4 (deflect sensor flap): between term. 3 and term. 4: Air-flow sensor defective.	6(-), 7	8...2500 Ω 300...550 Ω
Transmission identification Short to ground	75	7 5	Check lead for short to ground. Transmission control unit (if fitted) faulty. Continue testing with electronic transmission control.	8	———
No fault stored		1 2	Flashing code 1-2 is constantly repeated. Continue trouble-shooting with trouble-shooting chart.	—	———

Pressure regulator
* Fuel pressure 2,3...2,7 bar

Electric fuel pump
* Delivery (measured in return line) min. 850 cm ^{3} /30s
Supply voltage (under load): min. 12 V

Temperature sensor (intake air)
* Internal resistance measured at air-flow sensor between term. 4 and term. 5 at ambient temperature (+15°C...+30°C): 1450...3300 Ω

Temperature sensor (engine), plug color, blue.
* Internal resistance at ambient temperature (+ 15° C...+ 30° C): 1450...3300 Ω
engine at operating temperature (approx. + 80° C): 280...360 Ω

Solenoid-operated injection valve
* Internal resistance at ambient temperature (+ 15° C...+ 30° C): 14,5...17 Ω

Air-flow sensor
* Internal resistance between:
term. 2 and term. 4 : 8...2500 Ω (1)
term. 3 and term. 4 : 300... 550 Ω
term. 1 and term. 4 (CO potentiometer):
Minimum 0...30 Ω
Maximum: the actual value measured between term. 3 and term.4 may be up to 30 Ω less.

(1) Slowly deflect air-flow sensor flap as far as it will go.
Fluctuating increase in resistance; slight decrease towards end.

Engine-speed sensor and reference-mark sensor
* Internal resistance at ambient temperature (+15°C...+30°C): 400...800 Ω
* Air gap: 0,8 ± 0,5 mm

Throttle-valve switch/sensor
* Resistance of idle contact (term.18 and term.2 or term.4 and term.6): approx. 0 Ω
* Resistance of full-load contact (term.18 and term.3 or term.4 and term.5): approx. 0 Ω

Idle actuator
* Internal resistance at +15°...+30°C : approx. 8 Ω

Lambda sensor
* Resistance of heater winding 1...15 Ω

Ignition coil
* Primary resistance approx. 0 Ω
* Secondary resistance 6400...11100 Ω

Interference-suppression resistors
* H.T. distributor rotor: 1 k Ω
The secondary side of the ignition system must feature interference suppression of at least 5 k Ω overall resistance. H.T. resistance leads are fitted as standard.

TEST SPECIFICATIONS (CONTINUED)

Idle test:
Engine at normal operating temp.,
switch off consuming devices.
* Idle speed: 720...780 min $^{-1}$ +)

* Spark advance: 10 ± 5 ° crankshaft +)

Automatic transmission at N or P

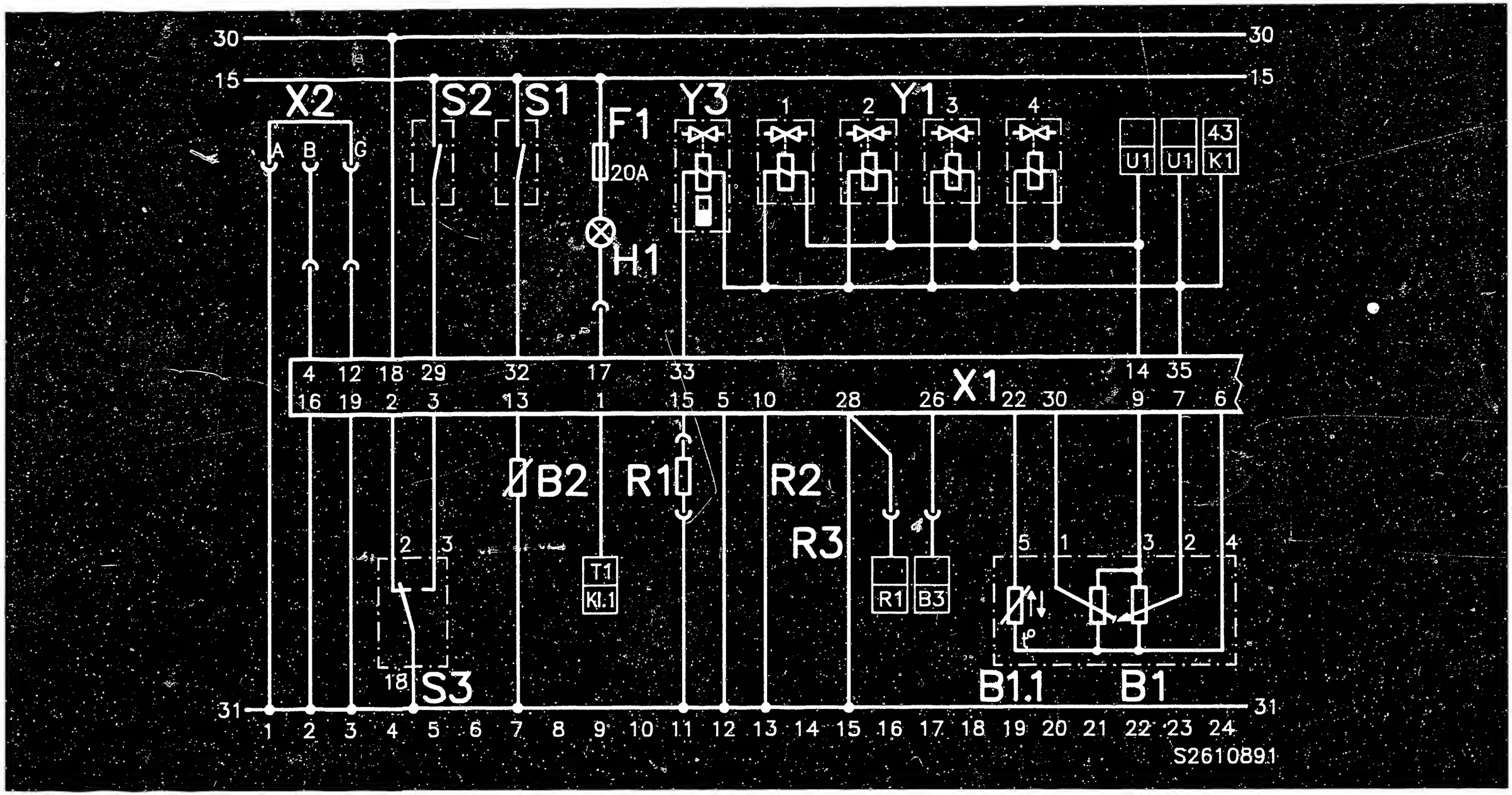
CO-content: without cat. converter
% CO by vol. 0,4...1 +)
Adjust mixture at CO
potentiometer in air-flow
sensor:
Turning counterclockwise results in a leaner mixture,
turning clockwise results in a richer mixture.
Using the potentiometer, the duration of
injection can be adjusted by max. 0,5 ms

* Catalytic-converter vehicles:: 0 % CO by vol.

For production reasons:
continued on the following
coordinate.

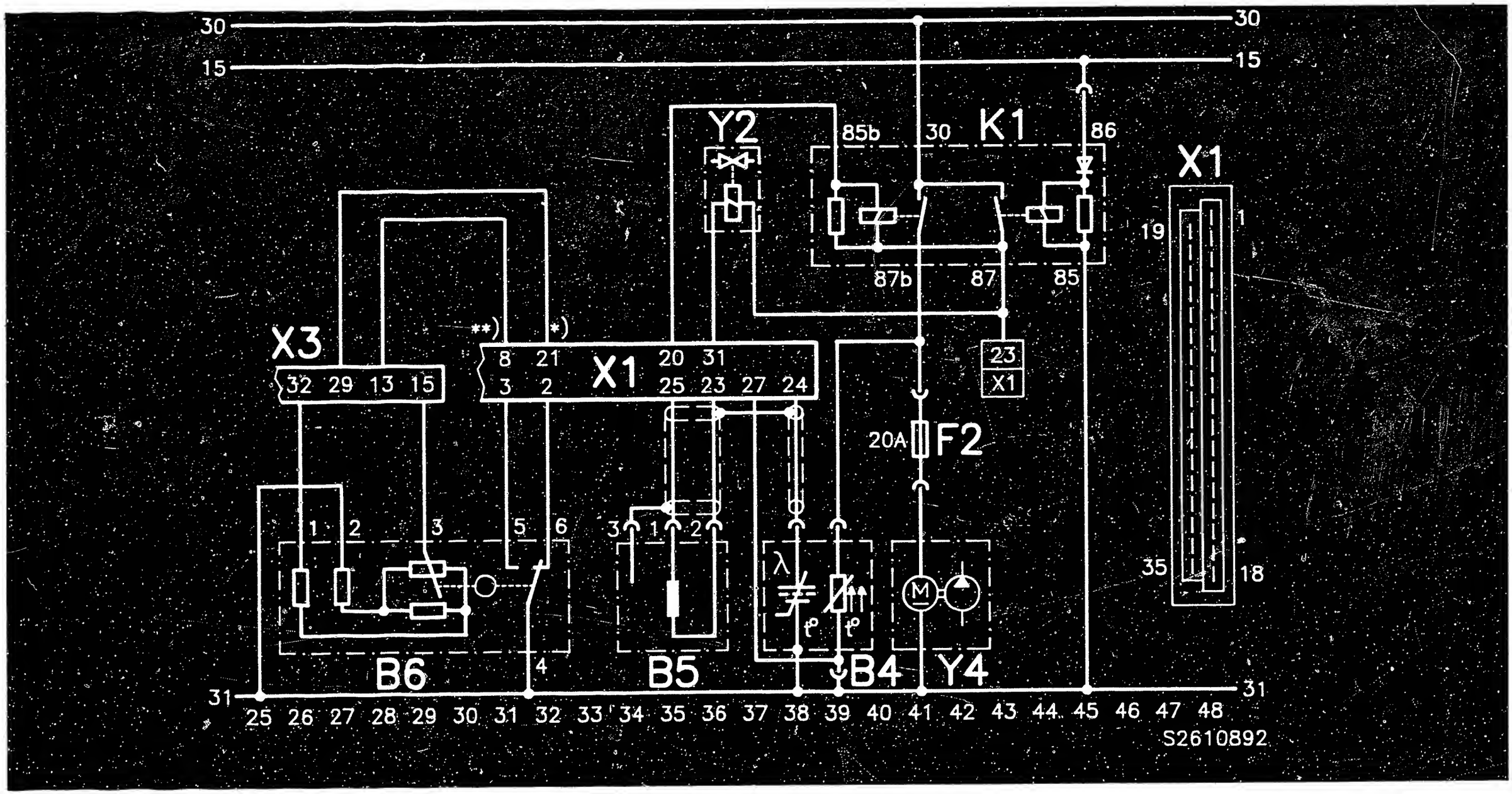
+) Attention! The basic value stated may deviate due to variant coding. Observe table in "Special features" section.

See equipment and Autodata microcards for setting values for valve clearance and other engine-specific data.



ELECTRICAL TERMINAL DIAGRAM

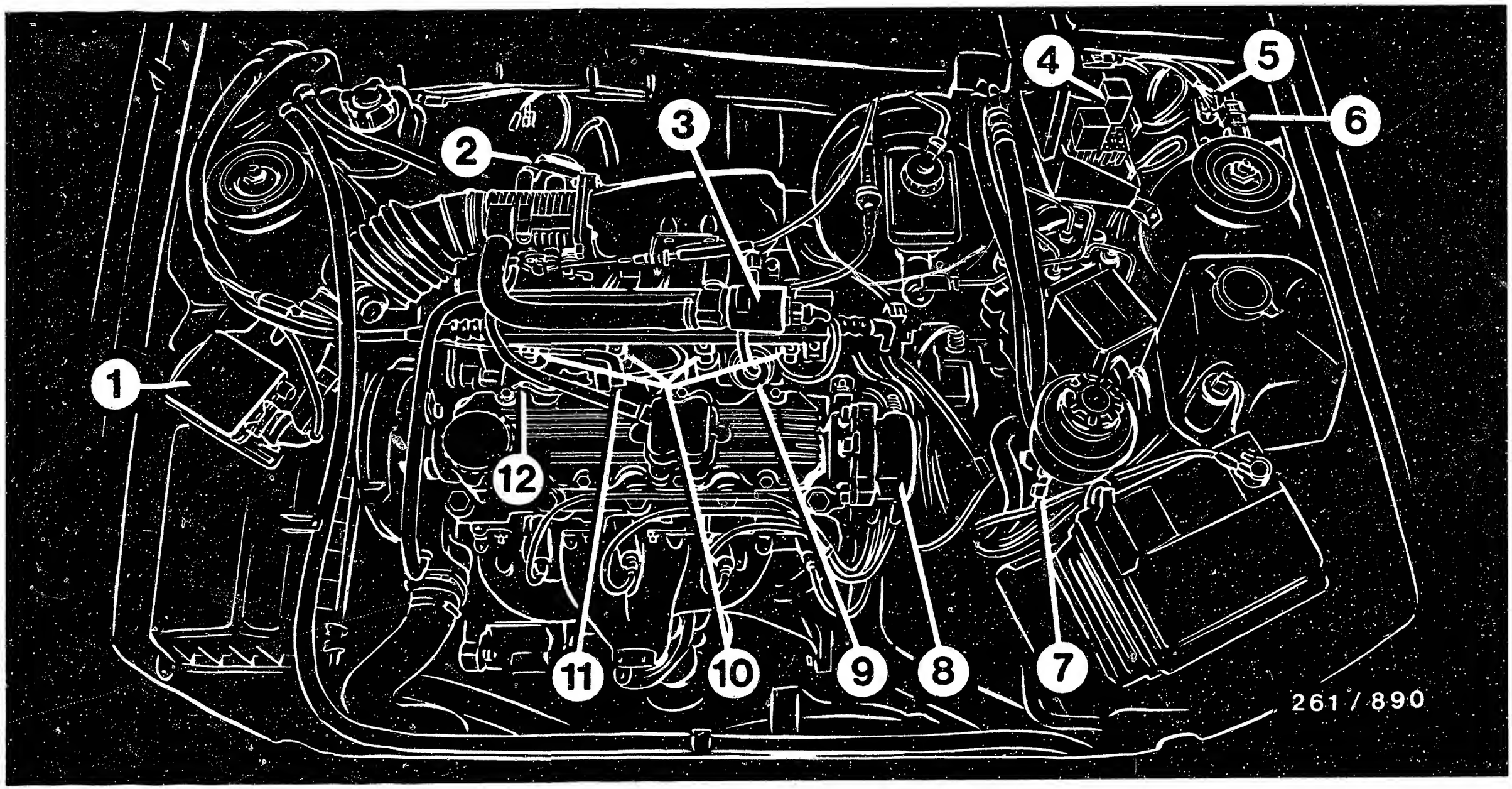
B1 = Air-flow sensor
B1.1= Temperature sensor (air)
B2 = Temperature sensor (engine)
B3 = Distance-travelled frequency sensor (if provided)
F1 = Fuse 20 A
H1 = Fault lamp
R1 = see variant encoding
R2 = only for automatic transmission
R3 = only for manual transmission
S1 = A/C
S2 = Compressor switch
S3 = Throttle-valve switch
T1 = Ignition coil
U1 = Vehicle computer
X1 = Motronic control-unit plug
X2 = Diagnosis plug
Y1 = Injection valves
Y3 = Idle actuator



ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

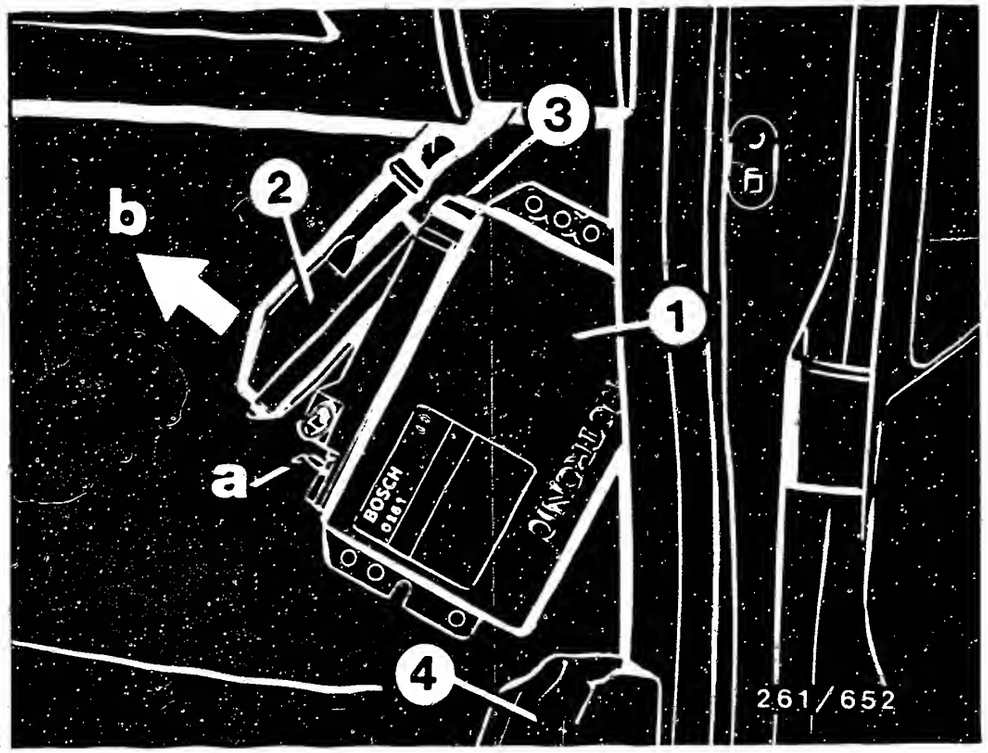
B4 = Lambda sensor
B5 = Engine-speed/reference-mark sensor
B6 = Throttle-valve switch with potentiometer for electronic transmission control (not from Bosch)
F2 = Fuse 20 A
K1 = Motronic relay
X1 = Motronic control-unit plug
X3 = Transmission control-unit plug (if provided)
Y2 = Tank ventilation valve
Y4 = Electric fuel pump

*) = Output for engine speed
**) = Electric fuel pump



INSTALLATION POSITION OF COMPONENTS

1 = Air-flow sensor
2 = Throttle valve switch (sensor)
3 = Idle actuator
4 = Motronic relay
5 = Diagnosis plug
6 = Octane-number encoding plug
7 = Ignition coil
8 = H. T. distributor
9 = Pressure regulator
10 = Injection valves
11 = Tank ventilation valve
12 = Ground terminals



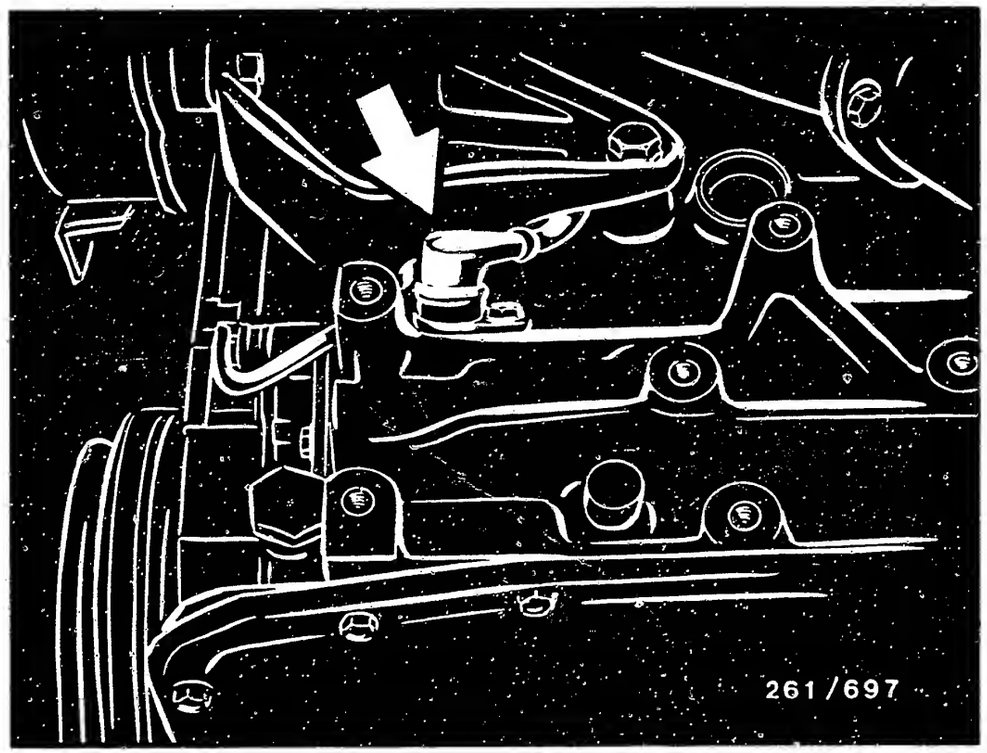
1 = Control unit
2 = Plug
3 = Mechanical encoding with engaging lug
4 = Cover over door sill

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The installation locations always refer to the direction of travel.

* Control unit:
  In passenger-side footwell, right.
  Lift plastic cover at door sill and remove control-unit cover.
  Unscrew control unit. Disengage plug (a), raise (arrow b) and detach (item 3).

* Temperature sensor (engine):
  in engine block beneath alternator mount.



Arrow = Reference-mark/engine-speed sensor

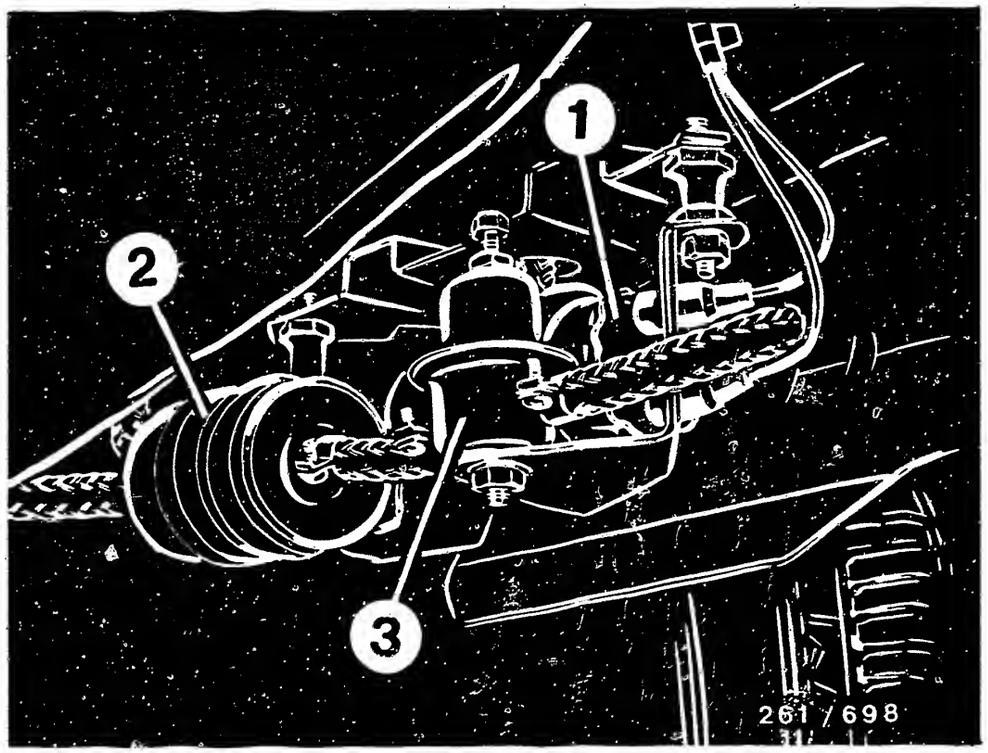
INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Reference-mark/engine-speed sensor:
  In engine block, left, behind V-belt pulley beneath fastening flange.

* Lambda sensor:
  In common exhaust pipe before catalytic converter.

* Fuses:
  In instrument panel at bottom left.
  Fuse box can be hinged out on its lower side.

* Temperature sensor (air):
  In air-flow sensor



1 = Electric fuel pump
2 = Fuel filter
3 = Pressure damper

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Electric fuel pump and fuel filter:
  To left of right-hand rear wheel.

* Ground terminals:
  At engine block, front right, beneath screw cover for engine oil.

* Diagnosis plug:
  In engine compartment, left at spring-strut dome.

* Octane-number encoding plug:
  In engine compartment on left at spring-strut dome.

* Tank ventilation valve:
  In engine compartment between valve cover and injection valves.

* Carbon filter:
  In right-hand front wheel house behind trim for A-pillar.

Trouble-shooting instructions :

BOSCH system	: Automatic heater and air conditioner (Tempmatik)
Make of vehicle	: MB-5032
Basic microcard	: MERCEDES-BENZ

TABLE OF CONTENTS

SPECIAL FEATURES

This microcard contains trouble-shooting instructions for the electronic automatic heating and air-conditioning system (Tempmatik)
in MERCEDES-BENZ vehicles
Type W 124: 200 D...300TE (08.85 ->)
Type C 124: 230CE...300CE (08.85 ->)
Up to 08.85, no Tempmatik systems featured temperature-regulated emergency shutdown for the A/C compressor.
As of 08.85, a temperature switch for emergency shutdown of the A/C compressor was installed to protect the engine against thermal overload.
The A/C compressor is switched off via the compressor control unit at a coolant temperature of approx. 110 Grad C.
If the engine temperataure drops off, the A/C compressor is switched in again via the control unit.
Installation position:

Gasoline engine	102 -	Engine compartment, front right at coolant pump.
	103 -	Engine block, top right in center
Diesel engine	602/-603	Engine compartment, front right in coolant inlet.

As of 09.87 the control unit on the Tempmatik was integrated into the operating element.
The control unit was additionally equipped with self-diagnosis.
As of 09.87, the temperature-regulated emergency shutdown for the A/C compressor is controlled by a temperature sensor.
The control unit switches off the A/C compressor in 2 stages.
1st stage
The switch-on duration is reduced by 50% at a coolant temperature of 117 Grad C for gasoline engine and 122 Grad C for diesel engine.
Switching of the compressor is clocked.

SPECIAL FEATURES (CONTINUED)

2nd stage

The A/C compressor is switched off completely at a coolant temperature of 120 degrees C for petrol engines and 128 degrees C for diesel engines.
If the coolant temperature drops, the compressor is clocked (1st stage) or fully switched in.

Installation position:
Petrol engine 102/103 – on engine block, top right or left.
Diesel engine 601–603 – in engine compartment, front right in coolant inlet.

Actuation of the auxiliary fan (2nd stage) and the fresh–air/circulating–air flap has been incorporated into the control unit for the automatic heating and air conditioning system.

The switching points for the auxiliary fan differ for vehicles with diesel/petrol engine.

The A/C switch has been modified.
There is no "EC" button. Instead, the fresh–air/circulating–air flap switch has been integrated into the A/C switch.

The "EC" function (A/C compressor off) is selected if none of the A/C system buttons are pressed.

A double contact relay for auxiliary fan, 1st stage and radiator magnetic coupling is installed in place of the changeover relay on types 200...230TE (4–cyl. engines).

The idle is stabilised by way of a bypass valve with the refrigerator compressor switched in on vehicles with no electronic induction of fuel (Types 200 and 200T).

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle–specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble–shooting chart leads to different causes/component faults.
For a detailed description of trouble–shooting, see the information in the trouble–shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle–related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High–performance ignition system with dangerous primary and secondary voltages!

Touching voltage–carrying components or terminals may prove fatal (both on the primary and secondary sides).

Customer complaint (symptoms of trouble)

1. No or poor heating effect	2. No or poor cooling effect	3. Heating blower cannot be regulated	4. Incorrect air distribution	5. Circulatory operation not possible	6. Auxiliary fan is not switched in	7. Idling problems on switching in the refrigerant compressor	Cause (component fault)
*	*	*	*	*	*	*	Evaluate self-diagnosis
*							Coolant level too low
	*						Check refrigerant level
	*						Drier defective
	*						Compacitor dirty
*							Auxiliary heating-water pump mechanically defective
*	*						Heating-water valve mechanically defective
	*						Check control unit of compressor cutoff
	*						Check TD signal to control unit of compressor cutoff
	*						Check speed sensor of refrigerant compressor
	*						Pressure switch defective
	*						Compressor clutch defective
	*						Belt drive loose

Customer complaint (symptoms of trouble)

1. No or poor heating effect	2. No or poor cooling effect	3. Heating blower cannot be regulated	4. Incorrect air distribution	5. Circulatory operation not possible	6. Auxiliary fan is not switched in	7. Idling problems when switching in the refrigerant compressor	Cause (component fault)
*		*					Check blower switch
*		*					Series-resistor group of blower motor defective
*		*					Blower motor defective
	*				*		Auxiliary fan mechanically defective
					*		Check series resistor of auxiliary fan
*	*		*				Adjusting flaps mechanically defective
				*			Change-over valves mechanically defective
				*			Check switch of fresh-air flap/ circulating-air flap
*	*		*	*			Check vacuum system
*	*						Check sensor blower
*	*			*	*		Control unit defective
						*	Check activation lead to KE-Jetronic

HOW TO USE THE SELF-DIAGNOSIS AND SELF-DIAGNOSIS TEST TABLE

Installed in this vehicle is a control unit which has a self-diagnosis facility. Therefore trouble-shooting must always be started with self-diagnosis.

The indicated faults in the automatic heater and automatic air conditioner are broken down in the self-diagnosis test table which starts on coordinates A09.
The self-diagnosis test table contains fault indication, component tested, test terminals at control-unit plugs, cause of trouble, test instructions and set values.

The trouble-shooting charts starting on coordinates A04 should be used only if a customer complaint has been received and there is no fault stored in the fault memory. Listed in the trouble-shooting charts are only those components which are not tested by the self-diagnosis facility.

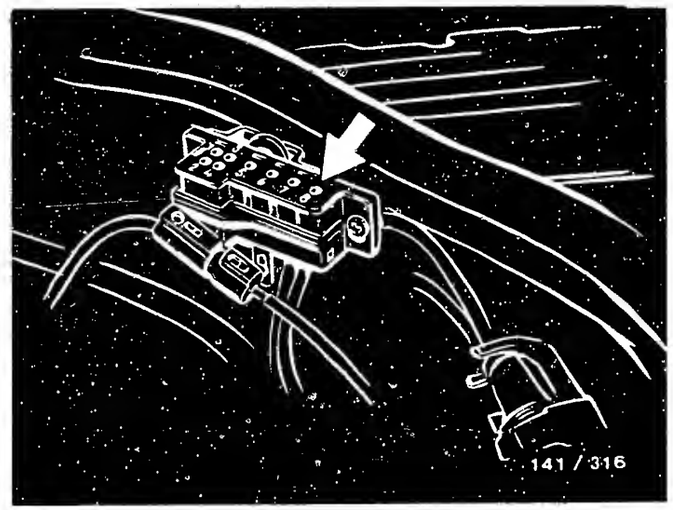
Activating the self-diagnosis:

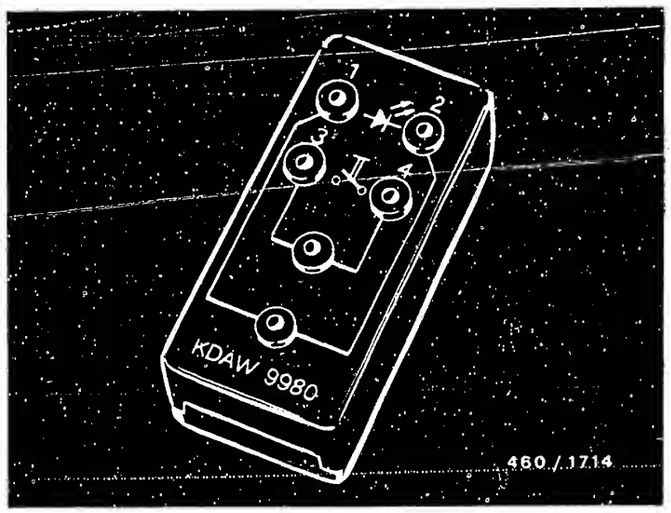
Connect sockets 2 and 4 of the flashing-code evaluation unit KDAW 9980 to socket 7 of the test coupling for diagnosis (upper illustration, arrow).
Connect evaluation-unit socket 1 to battery +ve and socket 3 to ground (socket 1 of diagnostic coupling).
Switch on ignition. Press push-button on evaluation unit for approx. 1 s.
Output of the self-diagnosis begins approx. 2 s. after stimulation with the first flashing code.
Each flashing code consists of a flashing-pulse block with 1 to 57 flashing pulses.

Continuing diagnosis:

After a fault has been read out, the next fault is output by pressing the push-button again. Continue diagnosis until the fault output first of all is repeated.
Diagnosis output can be ended only by switching off the ignition.

N o t e :
During diagnosis output, the LED in the fresh-air/circulation-air switch flashes.
If the control unit cannot be stimulated into outputting diagnosis, check whether the voltage supply of the control unit and the diagnostic lead from control unit term. 15 to the diagnostic test coupling socket 7 is open-circuited.





SELF–DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions		Terminals		Set values
1	Control unit and periphery	No fault present in system.		—		—
3	Passenger–compartment temperature sensor, open circuit	Check resistance of passenger–compartment temperature sensor:	at 10°C:	9	21	Approx. 18,3...21,5 k Ω
2	Passenger–compartment temperature sensor, short circuit		at 45°C:	9	21	Approx. 3,5... 4,5 k Ω
		Check leads for short circuit and open circuit.				
5	Ambient–temp. sensor, open circuit	Check resistance of ambient–temperature sensor:	at 10°C:	10	21	Approx. 5,0... 6,0 k Ω
4	Ambient–temp. sensor, short circuit		at 45°C:	10	21	Approx. 1,1... 1,3 k Ω
		Check leads for short circuit and open circuit.				
7	Evaporator–temperature sensor, open circuit	Check resistance of evaporator–temperature sensor:	at 0°C:	13	21	Approx. 30,0...35,0 k Ω
6	Evaporator–temperature sensor, short circuit		at 45°C:	13	21	Approx. 3,5... 4,5 k Ω
9	Discharge–temperature sensor, left, open circuit	Check resistance of discharge–temperature sensor, left:	at 10°C:	11	21	Approx. 18,3...21,5 k Ω
8	Discharge–temperature sensor, left, short circuit		at 45°C:	11	21	Approx. 3,5... 4,5 k Ω
		Check leads for short circuit and open circuit.				

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instruction/Test conditions	Terminals	Set values
11	Discharge-temperature sensor, right, open circuit	Check resistance of discharge-temperature sensor, right: at 10°C:	12 21	Approx. 18,3...21,5 k Ω
10	Discharge-temperature sensor, right, short circuit	at 45°C: Check leads for short circuit and open circuit.	12 21	Approx. 3,5... 4,5 k Ω
13	Coolant-temperature sensor, open circuit	Check resistance of temperature sensor (coolant): at 20°C:	14 21	5,0... 8,0 k Ω
12	Coolant-temperature sensor, short circuit	at 100°C: Check leads for short circuit and open circuit.	14 21	300... 400 Ω
30	Auxiliary heating-water pump, short circuit, open circuit	Switch on ignition. Check supply voltage of auxiliary heating-water pump: Check leads for short circuit and open circuit. (Actuate "DEF" push-button.Heating-water pump must run.)	1 20	Greater than 10 V
31	Duo heating-water valve left, short-circuit or open circuit	Switch on ignition. Check supply voltage of heating-water valve, left: Check leads for short circuit and open circuit.	2 20	Greater than 10 V
32	Duo heating-water valve right, short circuit or open circuit	Switch on ignition. Check supply voltage of heating-water valve, right: Check leads for short circuit and open circuit.	3 20	Greater than 10 V
33	Control unit of compressor cutoff, short circuit	Switch on igntion. Check supply voltage of compressor-cutoff device: (Note: output signal can be tested only when compressor-cutoff device is connected). Check contacts of compressor-cutoff device (corrosion or lead fallen off). Check leads for short circuit and open circuit.	4 20	Greater than 10 V

SELF-DIAGNOSIS TEST TABLE

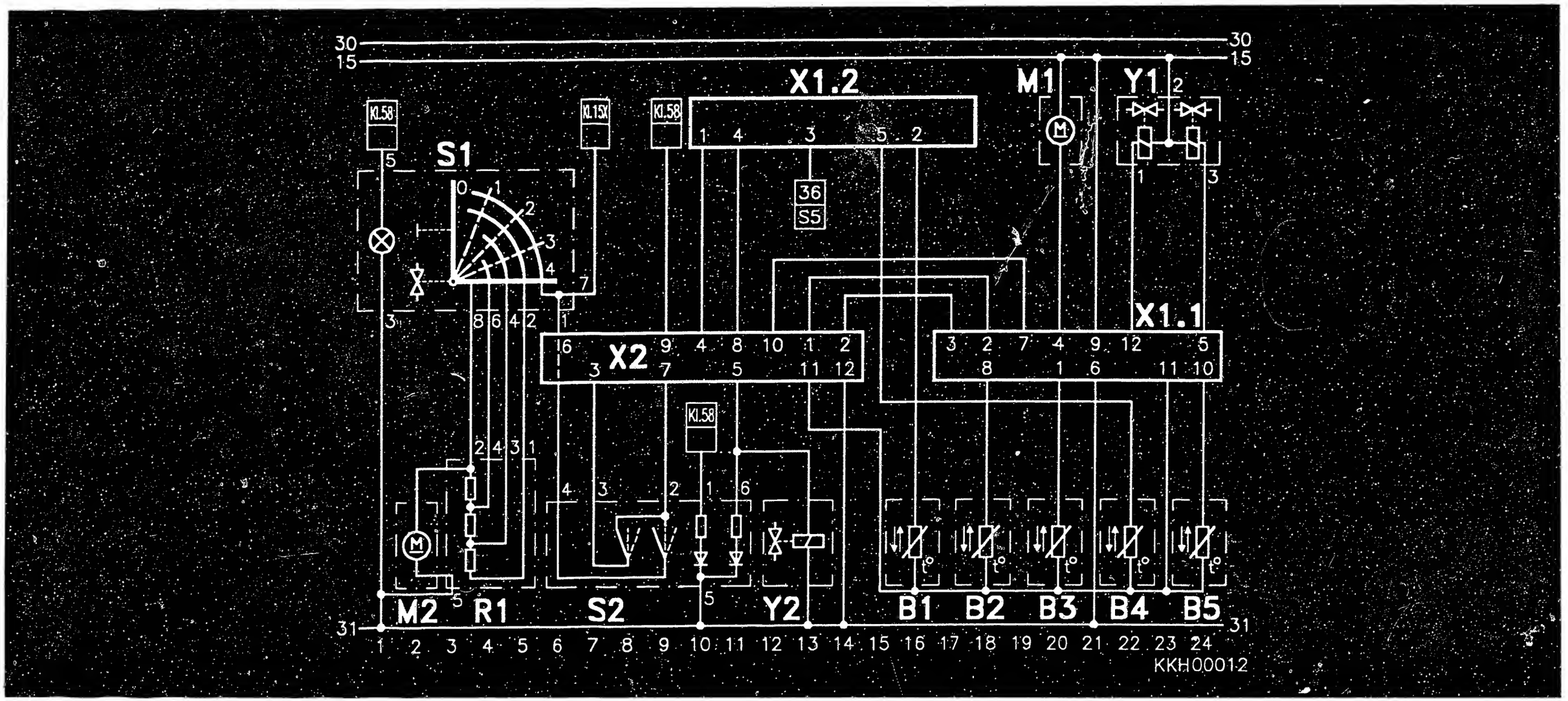
Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
34	Auxiliary fan, short circuit or open circuit	Switch on ignition. Check supply voltage of auxiliary-fan relay: Check leads for short circuit and open circuit.	7 20	Greater than 10 V
56	Circulating-air-flap change-over valve: large stroke, short circuit or open circuit	Switch on ignition. Check supply voltage of change-over valve: Check leads for short circuit and open circuit.	5 20	Greater than 10 V
57	Circulating-air-flap change-over valve: small stroke, short circuit or open circuit	Switch on ignition. Check voltage supply of change-over valve: Check leads for short circuit and open circuit.	6 20	Greater than 10 V

TEST SPECIFICATIONS

	Internal resistance
Passenger-compartment temperature sensor	21,5...3,5 k Ω at 10...45 °C
Discharge-temperature sensor	21,5...3,5 k Ω at 10...45 °C
Evaporator-temperature sensor	35...3,5 k Ω at 0...45 °C
Ambient-temperature sensor	6,0...1,1 k Ω at 10...45 °C
Heating-water valve	Approx. 10... 20 Ω
Coolant-temperature sensor	Approx. 5,0...0,3 k Ω at 20...100 °C
Change-over-valves internal resistance	Approx. 50... 80 Ω
Heating-water-pump power consumption:	Max. 1 A

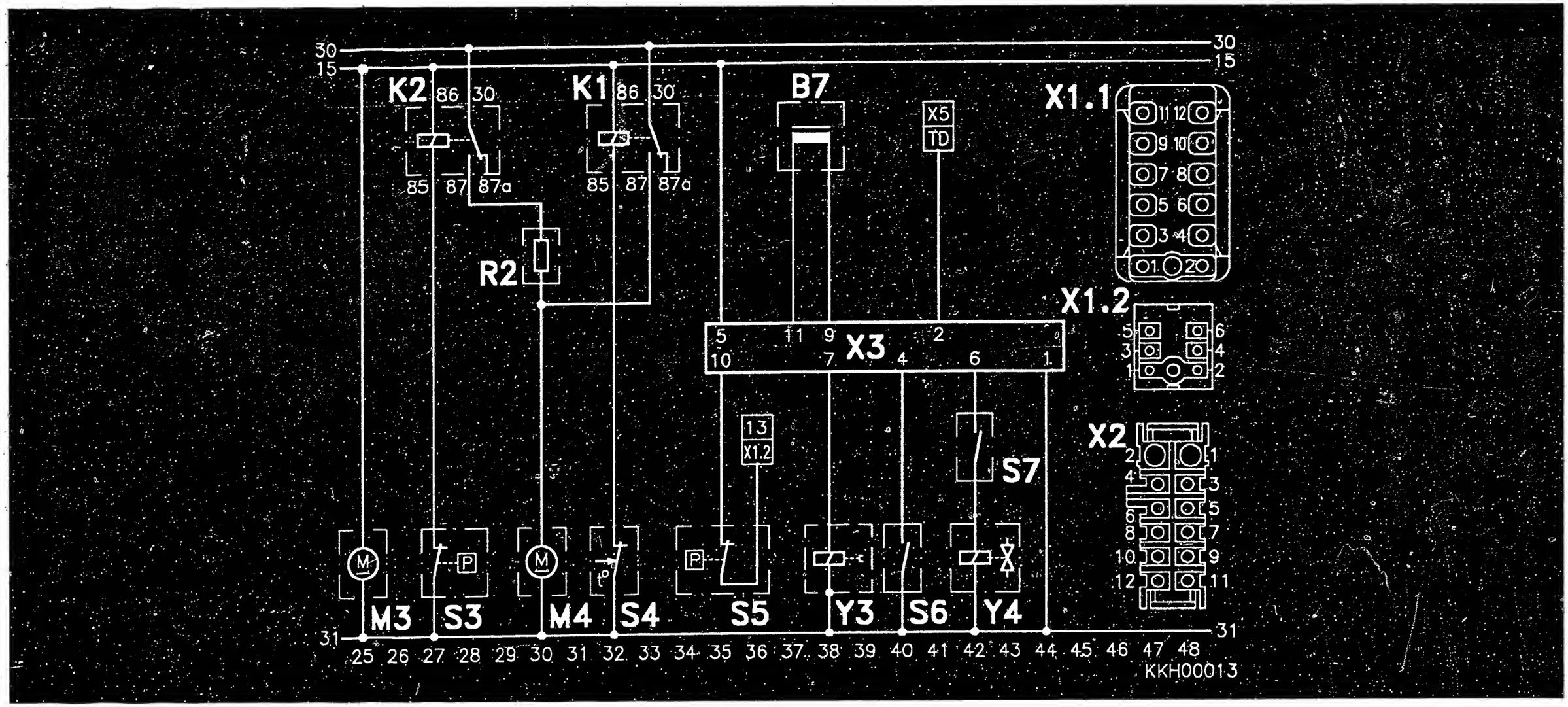
	Switching points
Low-pressure switch, compressor	Off at 2,0 bar On at 2,6 bar
High-pressure switch, compressor	Off at 30 bar On at 22 bar
Pressure switch, auxiliary fan	Off at 15 bar On at 20 bar

For production reasons:
continued on the following coordinate.



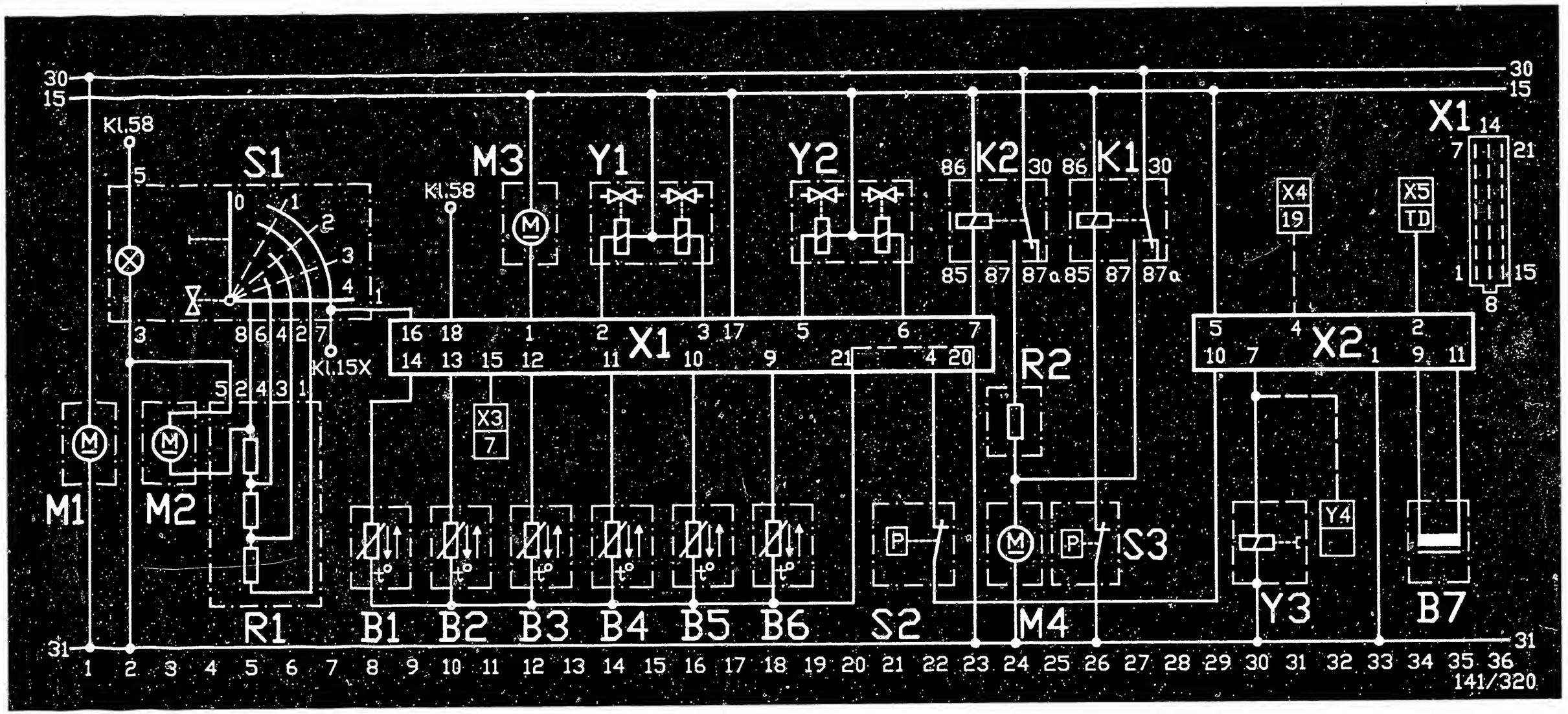
B1 = Evaporator-temperature sensor
B2 = Discharge-temperature sensor,right
B3 = Discharge-temperature sensor,left
B4 = Ambient-temperature sensor
B5 = Passenger-compartment temp. sensor
M1 = Heating-water pump
M2 = Blower motor
R1 = Series-resistor group, blower
S1 = Air-flow switch
S2 = Fresh-air/circulating-air switch
X1.1 = Control-unit plug, 12 pole
X1.2 = Control-unit plug, 6 pole
X2 = Plug, operating element, Tempmatik
Y1 = Twin heating-water valve
Y2 = Valve, fresh-air/circulating-air flap

TEMPMATIK ELECTRICAL TERMINAL DIAGRAM (Vehicles from year of manufacture 08.85 - 08.87)



B7 = Speed sensor, refrigerator compressor
K1 = Relay, auxiliary fan
K2 = Relay, auxiliary fan, series resistor
M3 = Air blower, passenger-compartment sensor
M4 = Auxiliary fan
R2 = Series resistor, auxiliary fan
S3 = Pressure switch, auxiliary fan
S4 = Temperature switch 110 °C
S5 = Pressure switch, refrigerator compressor
S6 = Microswitch, compressor shutoff
S7 = Kickdown switch
X3 = Control unit, refrig.-compressor shutoff
X5 = Plug, EI/TI control unit
Y3 = Magnetic coupling, refrigerator compressor
Y4 = Switching valve, automatic transmission

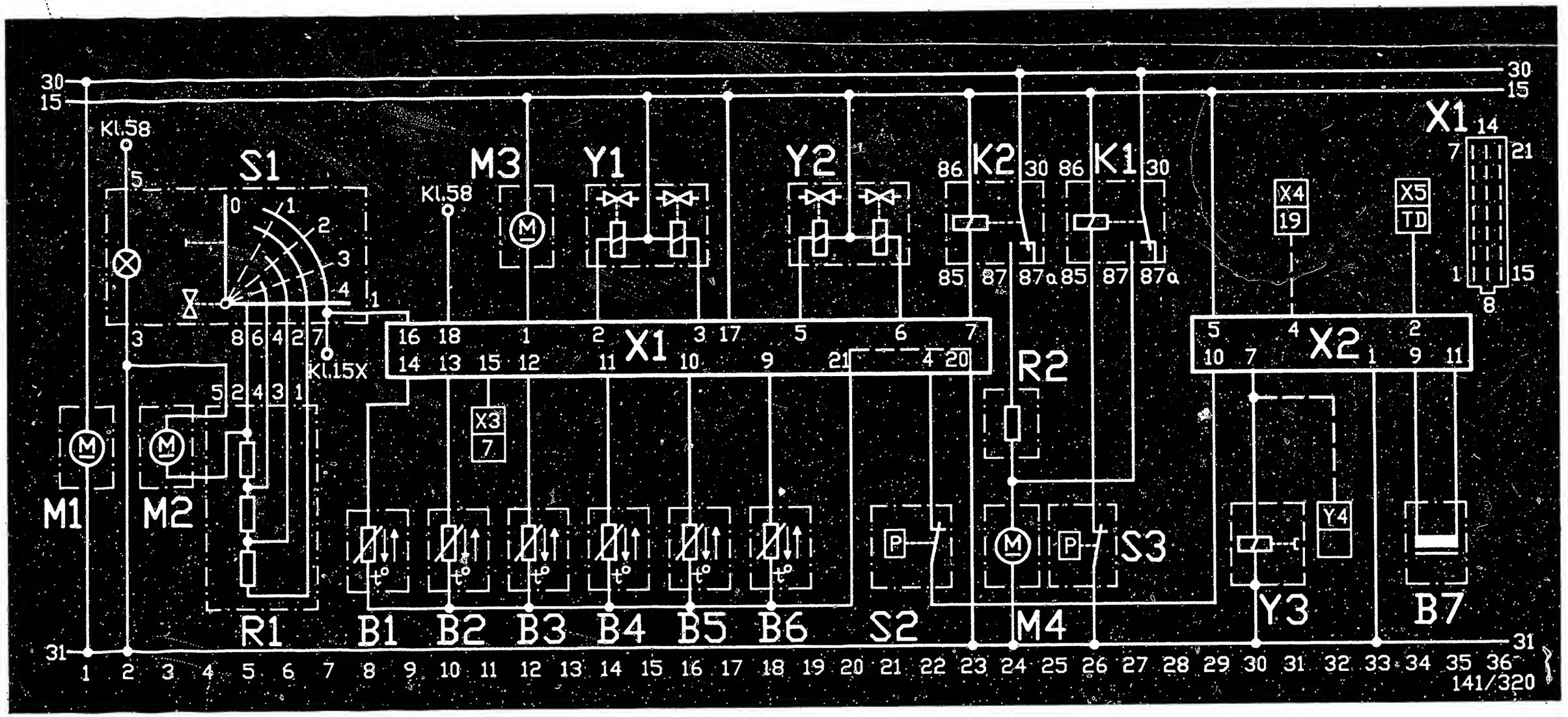
TEMPMATIC ELECTRICAL TERMINAL DIAGRAM (Vehicles from year of manufacture 08.85 - 08.87, continued)



B1 = Coolant-temperature sensor
B2 = Evaporator-temperature sensor
B3 = Discharge-temperature sensor, right
B4 = Discharge-temperature sensor, left
B5 = Ambient-temperature sensor
B6 = Passenger-compartment temperature sensor
B7 = Speed sensor, refrigerant compressor

K1 = Relay, series resistor of auxiliary fan (double-contact relay for magnetic clutch of engine fan in 200...230TE models)
K2 = Relay, auxiliary fan
M1 = Passenger-compartment sensor of ventilation blower
M2 = Blower motor
M3 = Heating-water pump
M4 = Auxiliary fan

ELECTRICAL TERMINAL DIAGRAM - TEMPMATIK (VEHICLES WITH SPARK-IGNITION ENGINE)



R1 = Series-resistor group, blower
R2 = Series-resistor, auxiliary fan
S1 = Air-flow switch
S2 = Pressure switch, refrigerant compressor
S3 = Pressure switch, auxiliary fan
X1 = Control-unit plug of Tempmatik with operating element (term. 21 and term. 22 connected internally in control unit)
X2 = Plug, control unit of compressor cutoff
X3 = Test coupling for diagnosis
X4 = Plug, control unit of KE-Jetronic (Ecotronic)
X5 = Plug, EI/TI control unit
Y1 = Duo heating-water valve
Y2 = Change-over valve, fresh-air/circulating-air flap
Y3 = Magnetic clutch, refrigerant compressor
Y4 = Bypass valve

ELECTRICAL TERMINAL DIAGRAM - TEMPMATIK (VEHICLES WITH SPARK-IGNITION ENGINE) (CONTINUED)

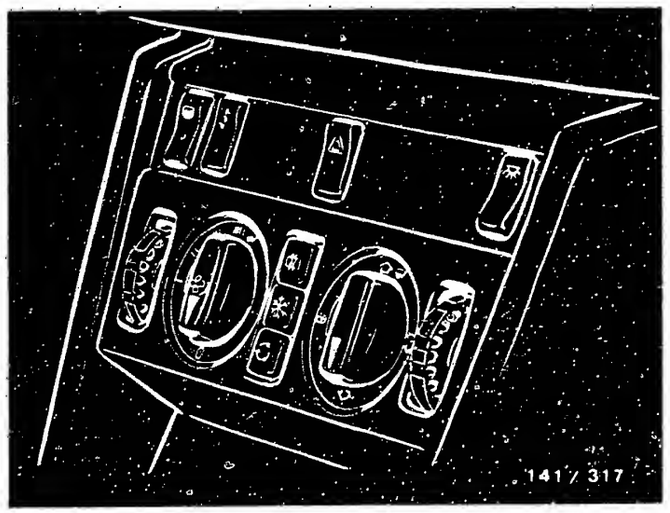
INSTALLATION POSITION OF COMPONENTS

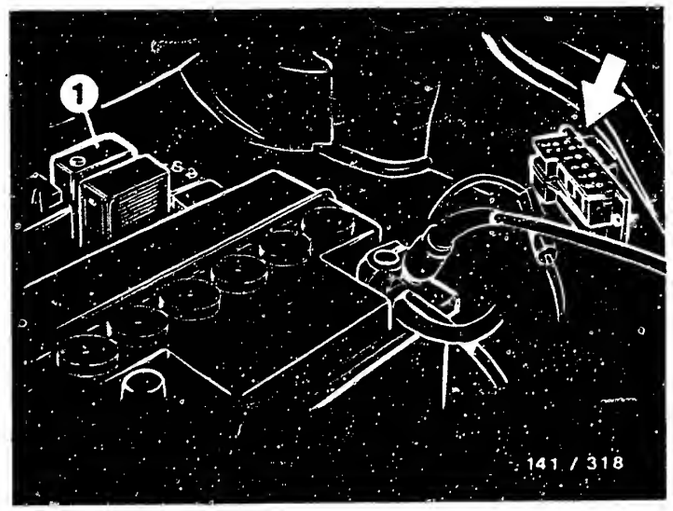
The electronic control unit in this system is integrated into the operating element (upper illustration).
The test coupling for diagnosis is installed in the engine compartment next to the heating-water valve (center illustration, arrow).

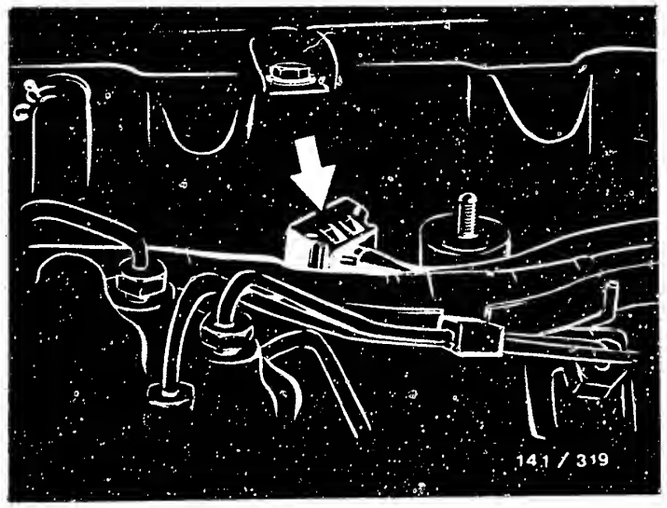
The control unit for compressor cutoff is installed in the engine compartment (center illustration, 1).

The coolant-temperature sensor is mounted on the cylinder head (lower illustration, arrow).

The installation positions of the remaining components have not changed compared with those given in the basic instructions.







Trouble-shooting instructions : VWW-5007

BOSCH system : Motronic (Digifant)

Make of vehicle : Volkswagen

Basic microcard : KFZ-00..

TABLE OF CONTENTS

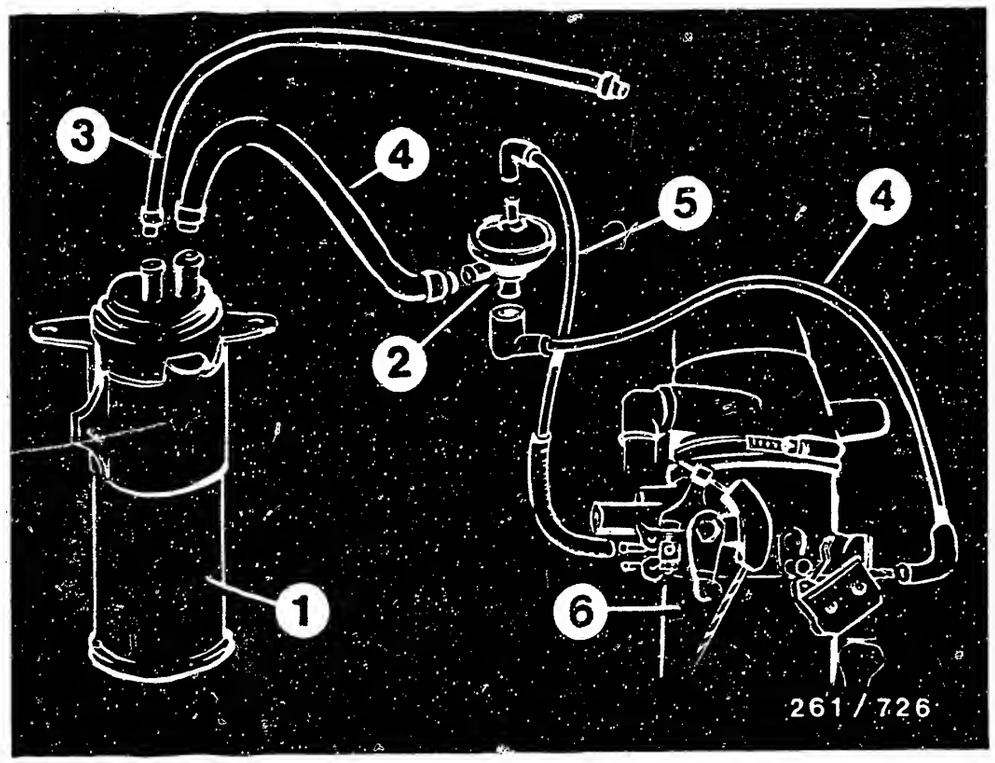
SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

* VW Golf, Jetta (03.87 ->)
  with 1.8 l / 4-cyl. engine
  with and without catalytic converter

Special features:

- 79 kW (107 bhp) engine, identification code "PF" with catalytic converter (without and with lambda sensor)
- 82 kW (111 bhp) engine, identification code "PB" without catalytic converter
- 77 kW (104 bhp) engine, identification code "RV" (US version)
- Crankshaft rotational speed and position is detected by means of "Hall generator" (engine-speed and reference-mark sensors not fitted)
- Control unit with 25-pin connector
- Low-idle-speed control
- Knock control



1 = Activation-carbon canister
2 = Tank-ventilation valve
3 = Tank-ventilation line
4 = Scavaging line (suction hose)
5 = Activating line
6 = Throttle-valve assembly

SPECIAL FEATURES (CONTINUED)

Tank-ventilation system:
Lambda closed-loop-control vehicles are equipped with a closed tank-ventilation system. The gasoline vapors produced in the fuel tank are fed through the tank-ventilation line into the activated-carbon canister. From here, the fuel vapors go into the activated-carbon charge.
The tank-ventilation valve has the task of feeding the gasoline vapors stored in the activated-carbon canister to the combustion chamber when a vehicle is being driven.
When the engine is at standstill or at idle, the tank-ventilation valve closes the scavaging line. When the engine speed is increased, the tank-ventilation valve opens.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
  Therefore, disconnect Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*											Voltage at control unit
*			*								Magnetic pulse generator
*		*		*	*						Fuel pressure
			*	*							Fuel delivery
*		*				*	*				Solenoid-operated injection valves
		*			*						Throttle valve
		*	*		*						Throttle-valve switch
		*									Overrun cut-off
	*	*	*								Idle actuator
		*									Idle speed, CO
*	*	*	*								Air-intake system
*	*	*	*	*	*	*					Air-flow sensor
					*	*					Air-intake temperature sensor
*	*	*	*	*	*	*					Temperature sensor (engine)
			*		*	*		*			Knock sensor
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*	*	*	*		Spark-advance angle
		*	*	*							Interference-suppression resistors
				*	*						Interference
	*	*	*				*				Tank ventilation
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*		*	*		Control unit

For production reasons:
continued on the following coordinate.

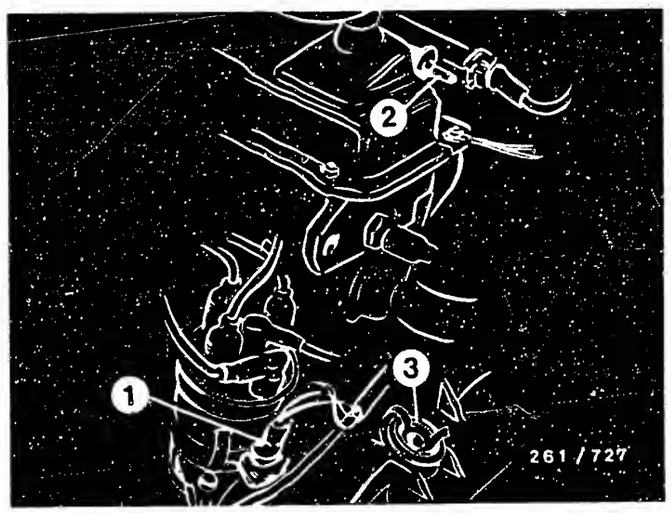
RAPID DIAGNOSIS CHART

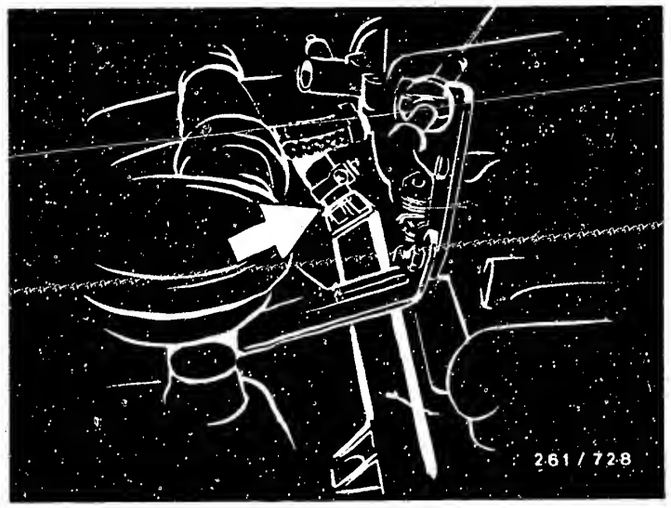
Test step	Testing of component/function	Test instructions/conditions	Control unit terms.	Set values
1	Leads to magnetic puise generator (Hall trigger)	Disengage gear, switch off ignition, detach Digifant control unit and pump relay. Detach plug at ignition distributor and jumper all three connections. Use test prods to measure resistance at open control-unit plug (25-pole). Take care not to damage spring contacts.	8<=>6 and 18<=>6	approx. 0 Ω (continuity)
2	Intake-air temperature sensor	Resistance at +15 ... +30° C:	9<=>6	1.45...3.30 k Ω
3	Coolant temperature sensor	Resistance at +15 ... +30° C: with engine at operating temperature:	10<=>6	1.45...3.30 k Ω 280... 360 Ω
4	Throttle-valve switch Idle contact	Accelerator pedal not actuated: Accelerator pedal depressed slightly (part-load range):	11<=>6	approx. 0 Ω (continuity) greater than 1 M Ω
5	Throttle-valve switch Full-load contact	Floor accelerator pedal (full-load stop): Slowly release accelerator pedal:	11<=>6	approx. 0 Ω (continuity) greater than 1 M Ω
6	Air-flow sensor (overall resistance)	Measure resistance:	17<=>6	500...1100 Ω
7	Air-flow sensor (wiper)	Slowly deflect sensor flap as far as it will go:	21<=>6	8...2500 Ω
8	Injection valves (4)	Winding resistance at +15...+30° C: Note: All valves in parallel	12<=>14	3.7... 5.0 Ω
9	Lead to lambda sensor	Separate lambda-sensor plug connection: Connect lambda input (green lead to control unit) to ground:	2<=>13	greater than 1M Ω approx. 0 Ω (continuity)
10	Heater winding of lambda sensor	Measure resistance at plug to lambda sensor between term. 2 and term. 3 (heater winding):	14<=>13	1...15 Ω (depending on temperature)

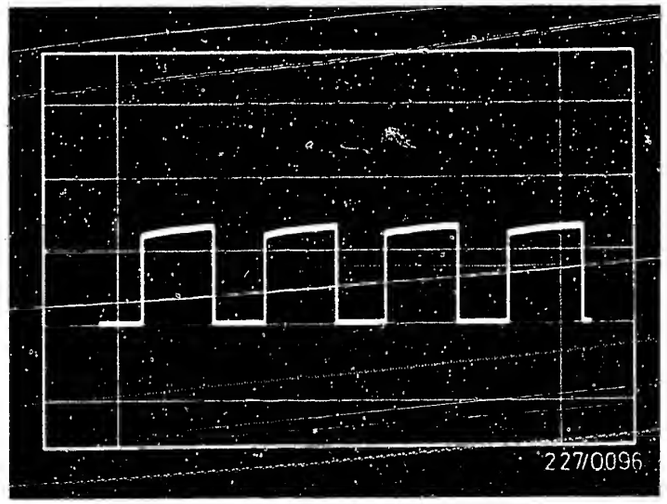
H07 — ==> H08 — <==>

RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Ctrl.-unit term-inals	Set values
11	Voltage measurement, switch over measuring range Main relay + supply leads; voltage supply of control unit. Switch on ignition:	14, 13 and 14, 19	10...15 V
12	Pump relay + supply leads; activation of electric fuel pump. Switch on ignition:	3, 13	10...15 V
13	Fuel pressure Switch off ignition, connect pressure gauge: -to fuel-distribution pipe, if V.A.G 1318/1 adapter fitted (upper illustration Item 2) or -to fuel inlet with Y connecting piece (center illustration, arrow). Switch on ignition, bridge term. 3 and term. 13 in the control-unit plug. Electric fuel pump must start to run audibly:	———	2,8...3,2 bar
14	Lead to term.50 (starting motor). Start signal. Shift into neutral and start:	1, 13	8...15 V
15	Ignition coil (primary winding) with supply leads, as well as connection from control unit term. 25 to ignition trigger box term. 6 (bridge term. 6 and term. 1 in 7-pin plug). Switch on ignition:	25, 13	10...15 V
16	Digifant control unit. Supply voltage of magnetic pulse generator. Connect control unit, push back rubber sleeve of plug on ignition distributor (upper illustration Item 1). Measure voltage at the two outer leads (+ and -) using test prods. Switch on ignition:	8, 6	10...15 V
17	Magnetic pulse generator, switching. As previously, however, test the voltage characteristic using oscilloscope (special input at the center connection (0) and vehicle ground. Start engine:	18, 6	See lower illustration

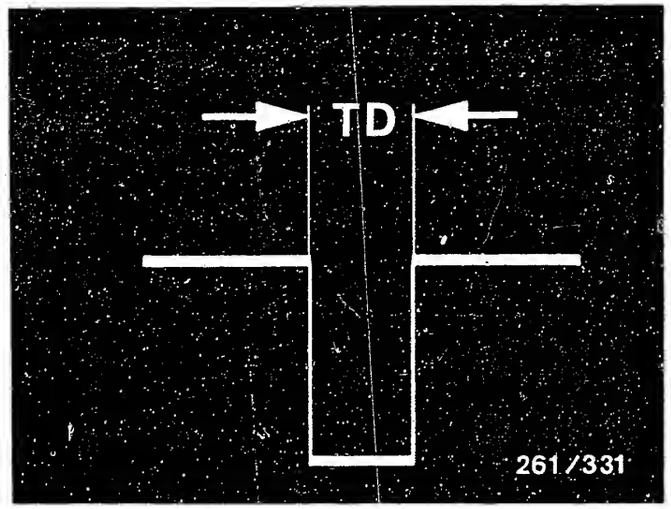


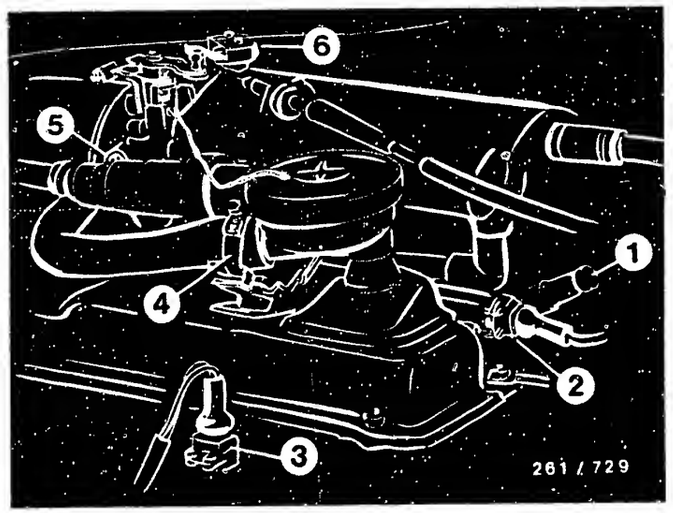




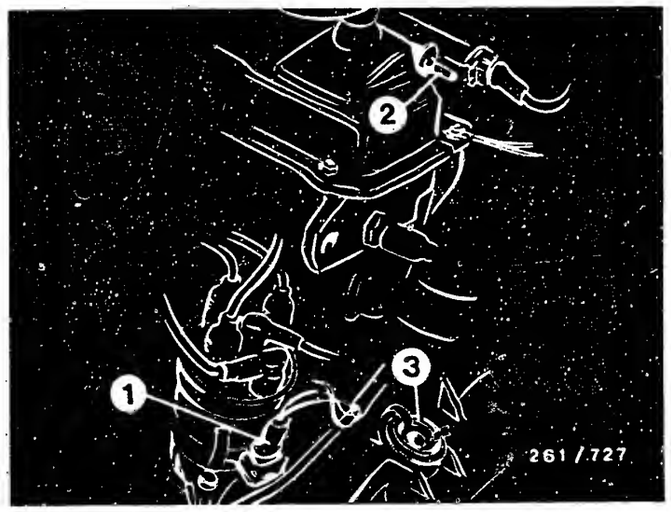
RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Ctrl.-unit ter-minals	Set values
18	Dwell-period signal Using oscilloscope (special input), test at ignition trigger box term. 6 and term. 2 (push back rubber sleeve). Shift into neutral and start.	25, ground	See upper illustration
19	Injection signal Using oscilloscope, test at common injection-valve plug (lower illustration, Item 2) (test lead 1 684 463 093). Shift into neutral and start.	14, 12	See center illustration
20	Voltage supply of air-flow sensor Push back rubber sleeve on air-flow-sensor plug and measure voltage between terminals 3 and 4 using test prods. Swith on ignition.	17, 6	Greater than 4,5 V
21	Air-flow sensor (wiper) As above, however, measure between terminals 2 and 4.	21, 6	Air-flow-sensor flap in rest position: 0,2...0,3 V Deflect air-flow-sensor flap fully: greater than 4,2 V
22	Overrun cut-off Start engine, increase engine speed to approx. 2000 min. $^{-1}$ and actuate full-load contact (lower illustration, Item 6) or idle contact (both contacts connected in parallel).	———	Engine (at normal operating temp.) hunts
23	Leads to knock sensor Pull apart plug-in connection to knock sensor and bridge all three connections in the plug. Measure resistance in the control-unit plug:	5, 4 and 7, 4	Approx. 0 Ω (continued)

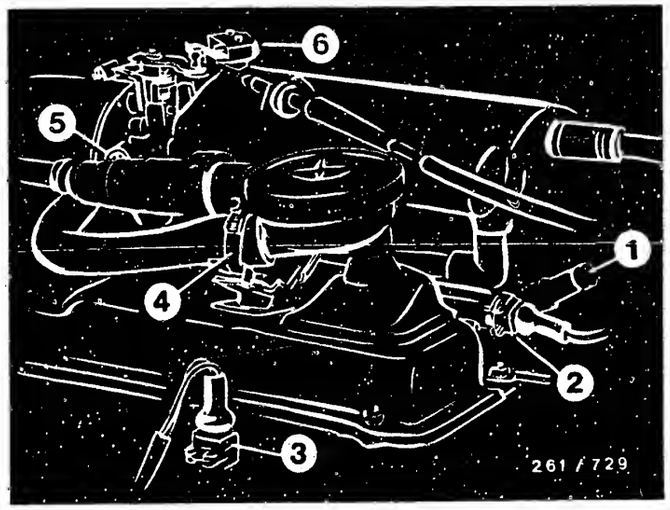




Test step	Testing of component/function Test instructions/conditions	Ctrl.-unit term-inals	Set values
24	Check spark-advance angle (basic setting). Engine at normal operating temperature, plug of temperature sensor (engine) disconnected. Engine speed 2000...2500 min $^{-1}$:	———	Basic setting value 4...8 °crankshaft
	Reconnect plug to temperature sensor (engine), engine speed approx.2300 min $^{-1}$. Subtract the basic-setting value from the spark-advance angle indicated and determine advance:		Advance 27...33 °crankshaft
	Note: If advance value is 10° crankshaft less than the set value, check the knock sensor (see "Test specifications") and determine spark-advance angle again. If necessary, replace knock sensor.		
25	Idle speed and CO. Connect motortester and CO analyzer (on vehicle with Cat, at CO measuring tube). Engine at normal operating temperature, loads switched off, disconnect hose of crankcase breather and seal off. Run engine for approx 1 min. at idle, then disconnect temperature sensor (engine), accelerate 3 times (3000 min-1) and measure idle speed/CO. Note: CO values must remain within tolerance after attaching temperature sensor and giving three bursts of throttle in excess of 3000 min-1. The idling speed should drop to:	———	900...1000 min $^{-1}$ (correction with idling-speed adjusting screw) Without lambda closed-loop control 0,5...1,5 % CO by vol. With lambda closed-loop control 0,3...1,1 % CO by vol. (correction with CO adjusting screw in air-flow sensor) 750...850 min-1



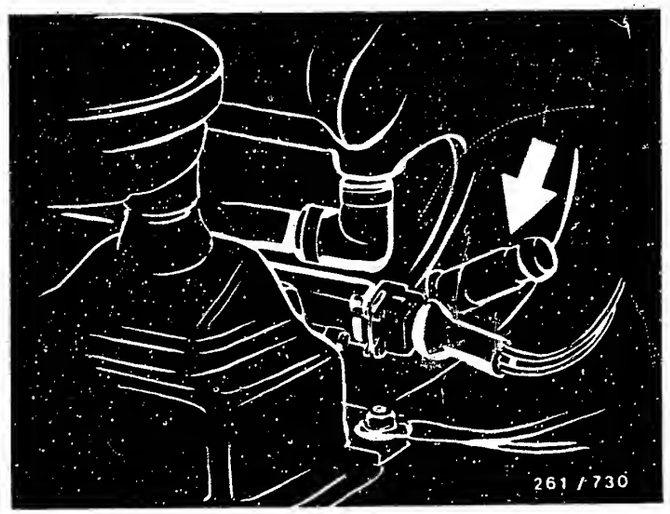
1= Plug on magnetic pulse generator
2= Pressure-gauge connecting point on fuel-distribution pipe
3= Ignition point or TDC marking (remove cap)



1= CO measuring tube on Cat
2= Common injection-valve plug
3= Temperature sensor (engine)
4= Crankcase breather
5= Idle-speed adjusting screw
6= Full-load switch

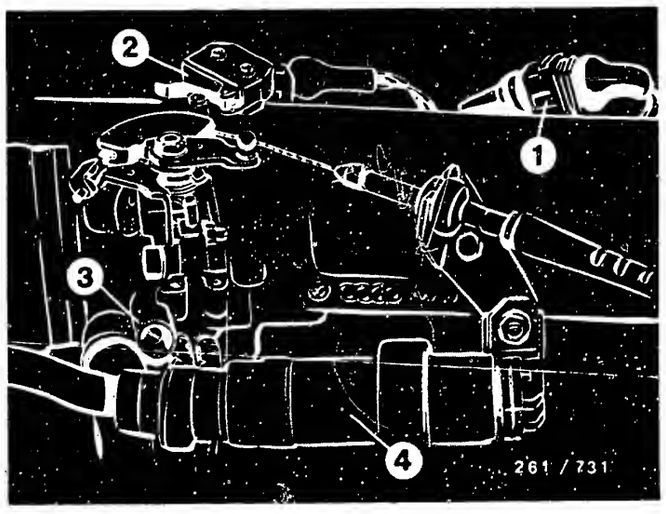
RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Ctrl.-unit term-inals	Set values
26	Idle-speed regulation Idle-actuator resistance: Check rotary actuator for freedom of movement; replace idle actuator if necessary. Measure idle-actuator current. Idling speed, engine at operating temperature, loads switched off. Temperature sensor (engine) disconnect, 1 minute idle + 3 x acceleration: connect, 1 minute idle + 3 x acceleration: Switch in loads (e.g. headlights, A/C system): Renew Digifant control unit if test conditions are complied with and set values are not OK.	——	2...10 Ω approx. 420 ± 30 mA approx. 420 ± 30 mA fluctuating in line with load 400...1000 mA
27	Upper limit of lambda closed-loop control. CO analyzer upstream of the catalytic converter (to CO measuring tube). Idle speed; engine and catalytic converter at normal operating temperature; pull apart plug in connection to lambda sensor and apply connection on control-unit side (black lead) to ground.	——	CO rises above 1,1 % by vol. (Conduct test step rapidly)
28	As Test step 27, however, test lower limit of lambda closed-loop control. Apply lambda input to approx. +2V, e.g. to positive terminal of a 1,5 V monocell (connect negative terminal to vehicle ground).	——	CO drops below 0,3 % by vol. (rough idling)
29	Control limit and lambda sensor in closed-loop-control mode. Plug-in connection to lambda sensor connected up; run engine (at normal operating temperature) at idle; note down CO values: Disconnect air hose from fuel-pressure regulator and seal off:	——	 CO= 0,3...1,1 % by vol. CO rises briefly and drops back to control value above



Arrow = CO measuring tube on Cat

1 = Lambda-sensor plug-in connection
2 = Full-load switch
3 = Idle-speed adjusting screw (Basic setting)
4 = Idle actuator



Idle speed: 800 ± 50 min $^{-1}$

Exhaust-gas adjustment
* CO value at idle with engine at normal operating temp.:
  version without catalytic converter 1,0 ± 0,5 %
  with catalytic converter without lambda sensor (1) 1,0 ± 0,5 %
  with catalytic converter and lambda sensor (1)(2) 0,7 ± 0,4 %

(1) = Measured at CO measuring tube
(2) = Lambda-sensor plug-in connection pulled apart

Pressure regulator
* Fuel pressure: 3,0 ± 0,2 bar

Electric fuel pumps
Fuel delivery (measured in return line)
* Fuel pump: at least 500 cm ^{3} /30s
* Pre-supply pump: at least 900 cm ^{3} /30s
* Supply voltage (under load): at least 12 V

Temperature sensor (engine)
Internal electrical resistance at
* ambient temperature (+15°C...+30°C): 1,45...3,3 k Ω
* with engine at normal operating temperature (approx. +80°C): 280...360 Ω

Solenoid-operated injection valve:
Internal electrical resistance at
* ambient temperature (+15°C...+30°C): 15...17,5 Ω

Idle actuator
* Internal electrical resistance: approx. 4 Ω

Knock sensor
* Internal electrical resistance: greater than 1 M Ω
* Tightening torque: 15...25 Nm
(when checking, first loosen screw)

Air-flow sensor

* Internal electrical resistance
  between term.2 and term.4: 8...2500 Ω (1)
  term.3 and term.4: 500...1100 Ω

(1) = (Deflect air-flow sensor flap as far as it will go).

Temperature sensor (intake air)

* Internal electrical resistance measured at air-flow sensor between term.1 and term.4 at ambient temperature (+15°C...+30°C): 1,45...3,3 k Ω

Ignition coil

* Primary resistance (term.1/term.15): 0,5...0,8 Ω
* Secondary resistance (term.1/term.4) : 2,4...3,5 k Ω

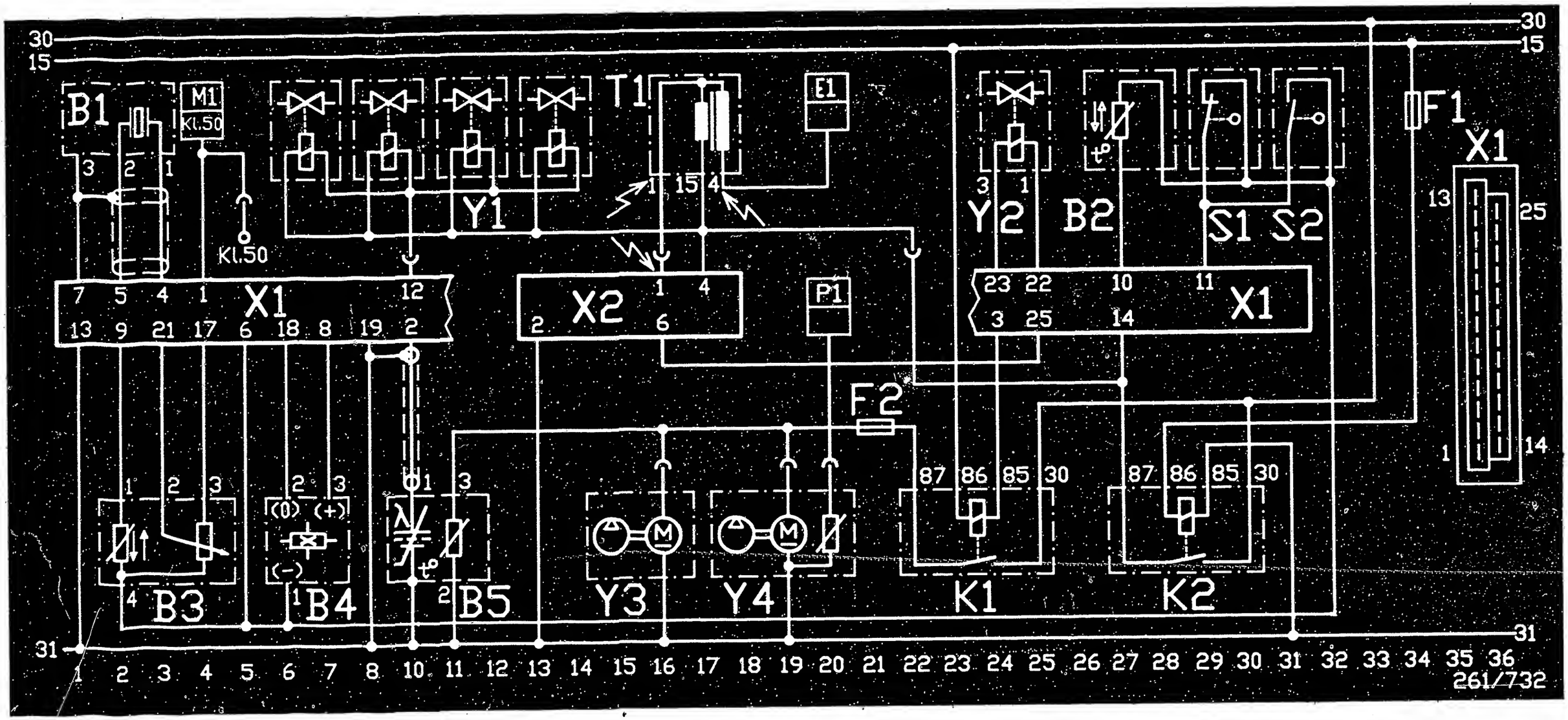
Lambda-sensor heater winding: 1...15 Ω

Interference-suppression resistors

* Ignition-distributor rotor: 0,6...1,4 k Ω
* Distributor cap : 0,6...1,4 k Ω
* Spark-plug connector : 4,0...6,0 k Ω

Vacuum unit and vacuum vessel (SS engine only)

* Vacuum: mbar
must not drop off within 2 minutes



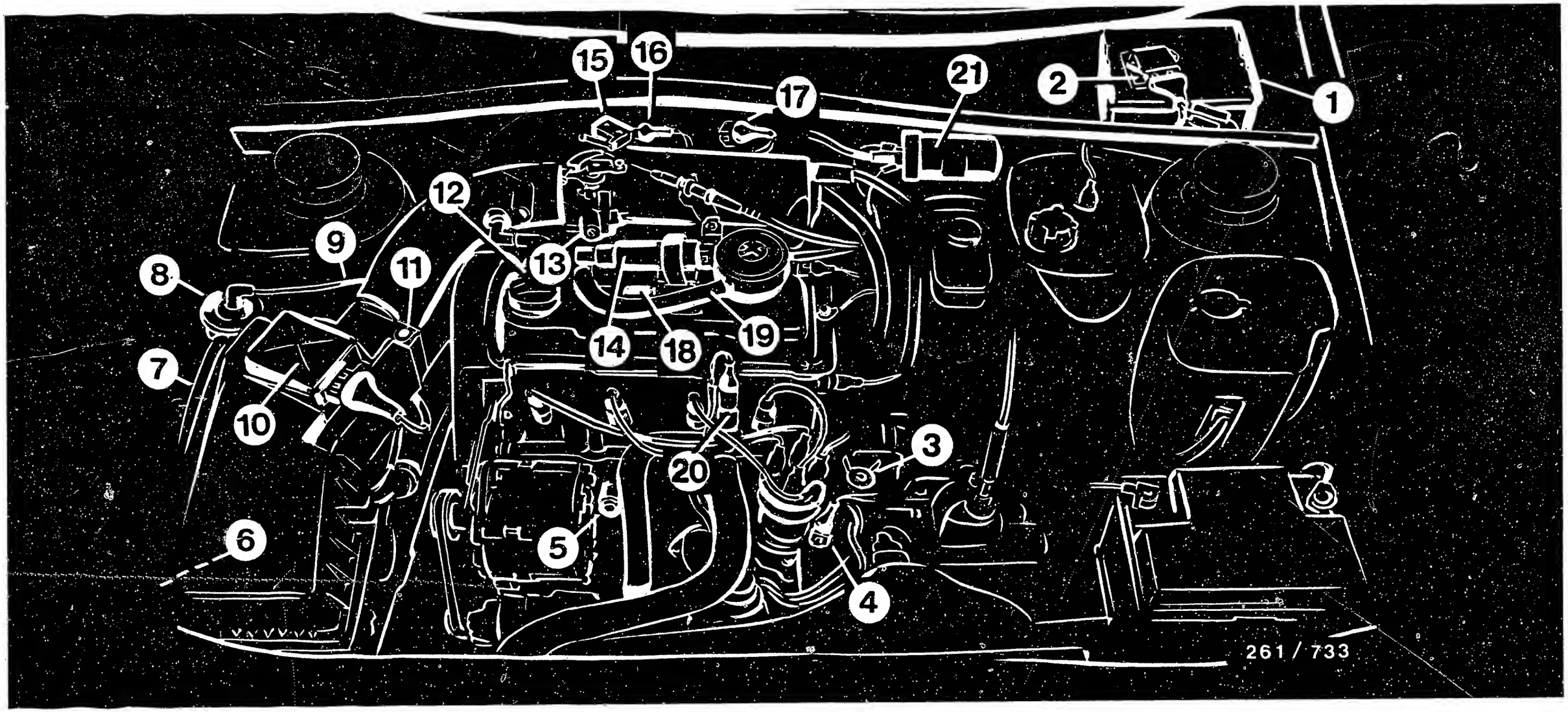
B1= Knock sensor
B2= Temperature sensor (engine)
B3= Air-flow sensor
B4= Magnetic pulse gen. (Hall generator)
B5= Heated lambda sensor (Cat)
E1= High-voltage distributor
F1= Main relay fuse
F2= Pump fuse

K1= Pump relay
K2= Main relay
M1= Starting motor
P1= Fuel gauge
S1= Idle switch
S2= Full-load switch
T1= Ignition coil
X1= Digifant control-unit plug

X2= Ignition-trigger-box plug
Y1= Solenoid-operated injection valves
Y2= Idle actuator
Y3= Electric fuel pump
Y4= Pre-supply pump with sensor (in tank) for fuel gauge

ELECTRICAL TERMINAL DIAGRAM - DIGIFANT

H19 ⟹
H20 ⟸



1= Digifant control unit
2= Ignition trigger box
3= TDC marking
4= Plug to magnetic pulse generator
5= Knock sensor
6= Activated-carbon canister of tank ventilation
7= Suction hose to activated-carbon canister (Cat)
8= Shutoff valve of tank ventilation
9= Activation lead
10= Air-flow sensor
11= CO adjusting screw
12= Pressure regulator (installation position only outlined in illus.)
13= Idle-speed adjusting screw
14= Idle actuator
15= Full-load switch
16= Plug to full-load/idle switch
17= Lambda-sensor plug-in connection
18= Injection valves
19= Hose for crankcase breather
20= Temperature sensor (engine)
21= Ignition coil

INSTALLATION POSITION OF COMPONENTS

H21 — ⟹

H22 — ⟺

INSTALLATION POSITION OF COMPONENTS (Continued)

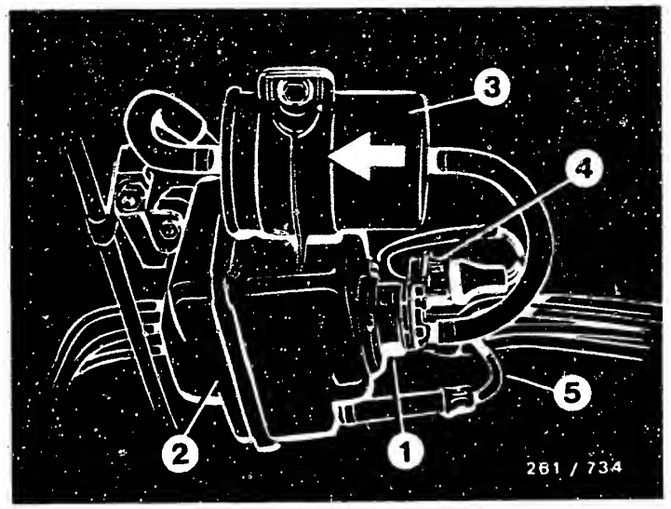
The indications "right" and "left" always refer to the forward direction of travel.

Main and pump relays and pump fuse:
In the fuse box underneath the instrument panel on the left-hand side.
Main relay in relay position No.1.
Pump relay in relay position No.2.
Pump fuse No.5 (fifth from left).

Fuel pump and fuel filter:
Beneath the vehicle near to the fuel tank.
See upper illustration.

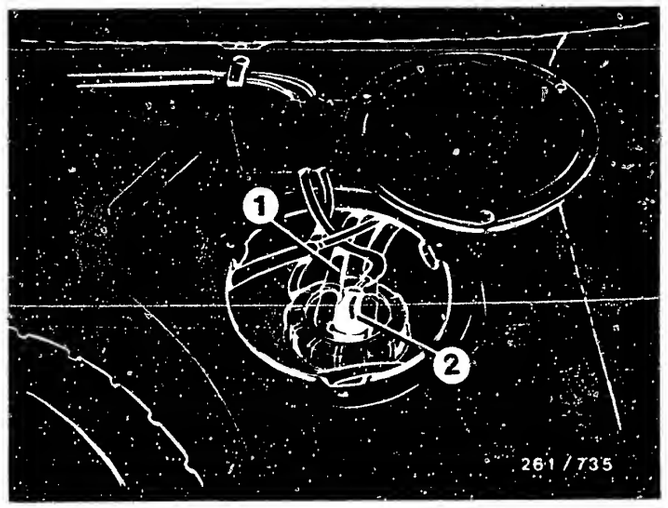
Pre-supply pump::
In the fuel tank (lower illustration).

Air-intake temperature sensor:
Integrated in the air-flow sensor.



1= Electric fuel pump
2= Pump accumulator
3= Fuel filter
4= Connector
5= From the pre-supply pump
Arrow= Direction of flow

Installation position of the pre-supply pump
1=Supply line (measuring point for fuel delivery of pre-supply pump)
2=Connector for pre-supply pump and fuel gauge

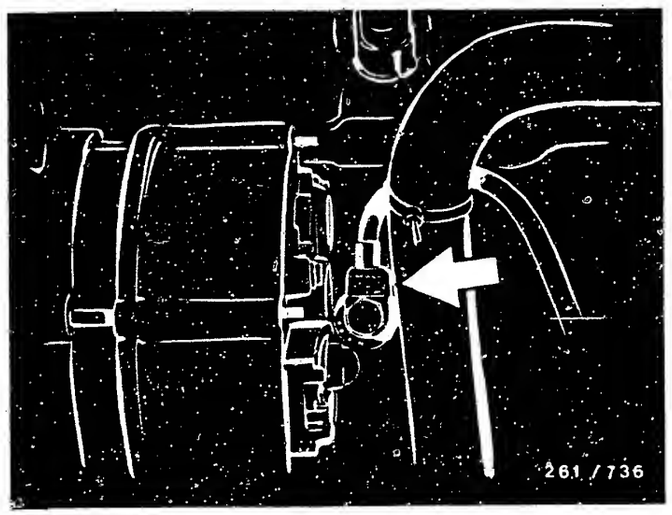


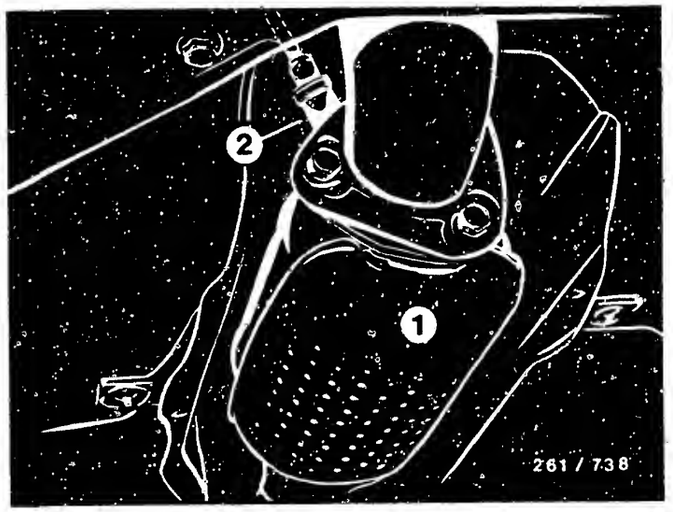
INSTALLATION POSITION OF COMPONENTS (Continued)

Knock sensor:
On the engine block at the front (upper illustration, arrow).

Plug-in connection to knock sensor:
Near to the ignition distributor (center illustration, arrow).

Lambda sensor:
In the catalytic converter.
See lower illustration ...Pos.1 = Catalytic converter.
Pos.2 = Lambda sensor.





T A B L E O F C O N T E N T S

Trouble-shooting instructions : VWW-5010

BOSCH system : Ecotronic

Make of vehicle : 4.0 B

Basic microcard : VW

SPECIAL FEATURES

* This microcard, valid at the time of publication, contains trouble-shooting instructions for the following VW models:
  Golf 10.87->
  1,61/4-cyl. engine code letter. PN
  Passat, Jetta 10.87->
  1,61/4-cyl. engine code letter. PP

* Ecotronic (ECO 4.0 B) with 25-pole control unit.

* The control unit features self-diagnosis. Should a fault occur in the system, it is stored in the fault memory and can be read out with the aid of the diagnosis evaluation unit KDAW 9980. The control unit makes use of specified substitute values should a sensor fail.
* The system is similar to the Ecotronic (ECO 3), Mercedes-Benz
  See basic microcard.

SPECIAL FEATURES (continued):

The control range of the lambda closed-loop control system can be indicated by means of an evaluation unit KDAW 9980 or by means of a commercially available LED test lamp.

Testing and adjusting lambda closed-loop control range:

The correct setting of the lambda closed-loop control range is indicated by way of flashing pulses from the LED.
Initiation of indication:
- Switch off ignition for at least 20 s.
- Connect evaluation unit for flashing code KDAW 9980 socket 2 and socket 4 to test coupling for diagnosis (free lead in engine compartment).
  Connect evaluation unit socket 1 to $+U_B$ and socket 3 to ground.
  Keep button on evaluation unit pressed and start engine.
- Release button on evaluation unit after engine has been running for at least 4 s.
- Bring lambda sensor up to operating temperature; to do so, increase engine speed for 1 min. to between in excess of 2000 and max. 3500 min^{-1}.
  Note: If the engine speed is increased to in excess of 4000 min^{-1}, the indication is reset; initiate indication again.

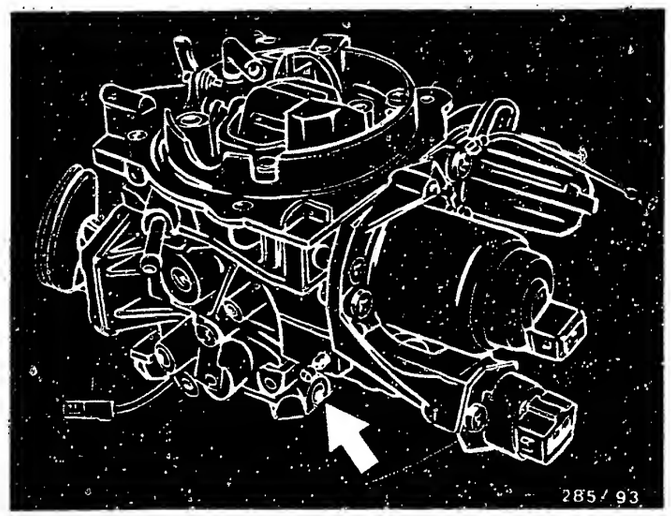
Lambda closed-loop control within control range:
LED flashes 1,5 times per second.

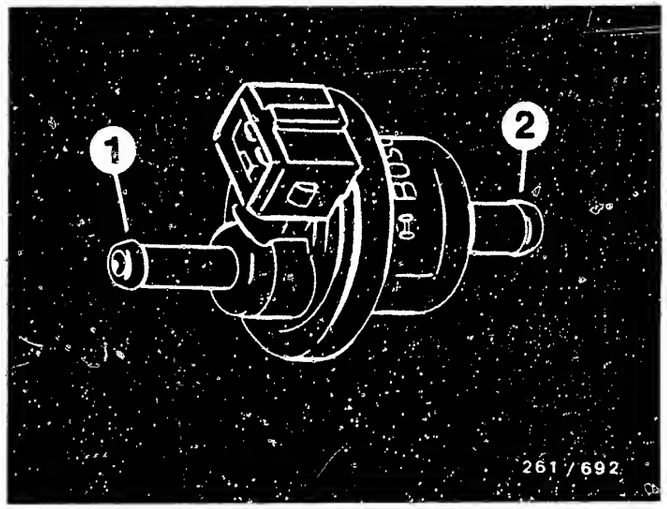
Lambda closed-loop control on rich stop:
LED lights up all the time.

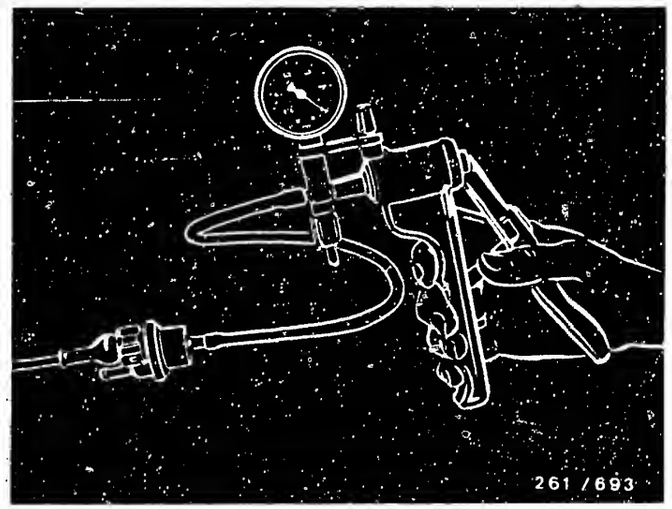
Lambda closed-loop control on lean stop:
LED does not light up.

Adjust closed-loop control range by way of idle-mixture-adjusting screw (top picture, arrow).
Note: LED flickers (25 times per second)
- Lambda sensor not at operating temperature
- Open-circuit in lead to lambda sensor.

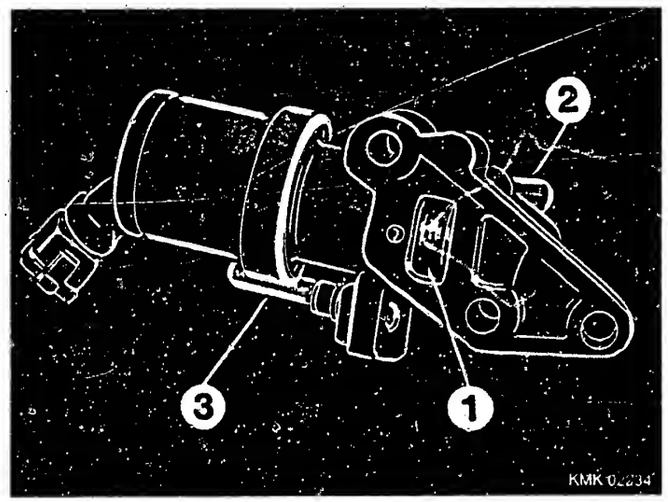
Testing ACF bleeder valve for leaks:
Remove ACF bleeder valve.
Connect vacuum pump (e.g. Mityvac) to intake-manifold connection of valve (center picture, 2).
1. Valve deenergized -> continuity (vacuum build-up not possible).
2. Actuate valve with battery voltage (10...15 V) (use connecting lead KDJE 7450/70) (bottom picture).
Generate vacuum of approx. 0,5 bar.
Permissible drop in pressure: 0,25 bar in approx. 10 s.







SPECIAL FEATURES (Continued)



Check tank ventilation:

Pull vacuum hose off at tank ventilation valve (connection to active–carbon container) and connect up vacuum gauge.
Engine idling at operating temperature (approx. + 80 Grad C).
Lambda control in operation. Observe vacuum reading.

Set value:
Change between 400...600 mbar and 700...1000 mbar
Increase engine speed to approx. 3000 1/min.

Set value:
500...1000 mbar

If set value is not attained, check vacuum hose to carburetor for leaks/check tank ventilation valve.

Visually inspect active–carbon container. Check for leaks in vacuum lines between active–carbon container and tank ventilation valve, float–chamber vent valve and tank.

Check electr. float–chamber vent valve (top picture):
Switch off ignition and check voltage supply.

Set value: approx. battery voltage

Unscrew vent valve and apply + 12 V.

Set value:
Valve plate (top picture, item 1) is pulled onto its seat and interrupts connection between float chamber and vacuum connections (top picture, items 2 and 3).

Renew vent valve if set value is not attained.

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart leads to various causes/component faults.
A detailed description of trouble-shooting is given in the trouble-shooting chart in the basic instructions.
NOTE: Even if reference is made to basic instructions, the set values, terminal assignments and special features indicated in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to information given in basic instructions so as to avoid endangering people and in order to prevent damage to engine, trigger boxes, control units or ignition system.

IMPORTANT!
Heavy duty ignition system with hazardous high and low voltage!

Coming into contact with components or terminals which carry voltage may be fatal (on both primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, induction of fuel).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	Evaluate self-diagnosis
								*	*	Poor grade of fuel
*			*	*	*					Test fuel pressure
	*			*	*					Test fuel delivery
*	*	*	*	*	*	*				Choke-valve flap not moving freely
*	*			*	*					Test float/needle valve
*	*	*	*	*	*					Dirt in carburetor
	*	*	*	*	*					Leak in intake system
	*	*								Defective intake-manifold heater
	*	*								Defective intake-air preheater
					*					Defective exhaust system
		*	*							Check tank ventilation

TROUBLE-SHOOTING CHART

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, induction of fuel).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	Cause (component fault)
	*					*				Test setting of throttle valve, stage I
	*	*	*	*	*					Wrong type of nozzle
		*		*						Vacuum unit, stage II
	*	*		*						Test setting of throttle valve, stage II
		*		*	*					Test setting of throttle linkage
	*	*								Throttle valve worn
*	*		*							Test TD signal
				*	*					Test enrichment pipe
	*	*								Test bypass heater
*				*	*					Defective float-chamber change-over valve
	*	*								Test ACF (visual inspection)
	*									Test vent. filter, throttle-valve actuator

TROUBLE-SHOOTING: HOW TO USE SELF-DIAGNOSIS:

This vehicle is fitted with a control unit which features self-diagnosis. Trouble-shooting must therefore always be commenced with self-diagnosis.
The self-diagnosis is split up into two parts:

1. Readout of fault memory (self-diagnosis)

2. Actuator diagnosis

Following stimulation of the self-diagnosis by way of the diagnosis evaluation unit, all electronic control units installed in the vehicle, which feature self-diagnosis, are prompted to provide diagnosis output.
The indicated Ecotronic faults are explained in the self-diagnosis test table starting on Coordinate 13.
The self-diagnosis test table contains fault indication, component tested, test terminals at control-unit plug, cause of fault, test instructions and set values.

The trouble-shooting charts as of Coordinates 06 are only to be employed if there is no fault stored in the fault memory, but a customer complaint has nevertheless been received.
The trouble-shooting charts only contain those components which are not tested by way of self-diagnosis.

HOW TO USE SELF-DIAGNOSIS AND SELF-DIAGNOSIS TEST TABLE

Connecting evaluation unit for flashing code KDAW 9980 (center picture):
Connect evaluation unit for flashing code KDAW 9980 socket 2 and socket 4
to test coupling for diagnosis (free lead in engine compartment, (top picture, arrow).
Connect evaluation unit socket 1 to $+U_B$ and socket 3 to ground.

Activating self-diagnosis:
Allow engine to idle (if applicable, perform test drive beforehand)
or crank starting motor for approx. 6 seconds (do not switch off ignition).
Press button on evaluation unit for more than 4 s.
Output of the self-diagnosis commences with a start signal (bottom picture, a) (fault lamp lights up for approx. 2,5 seconds).

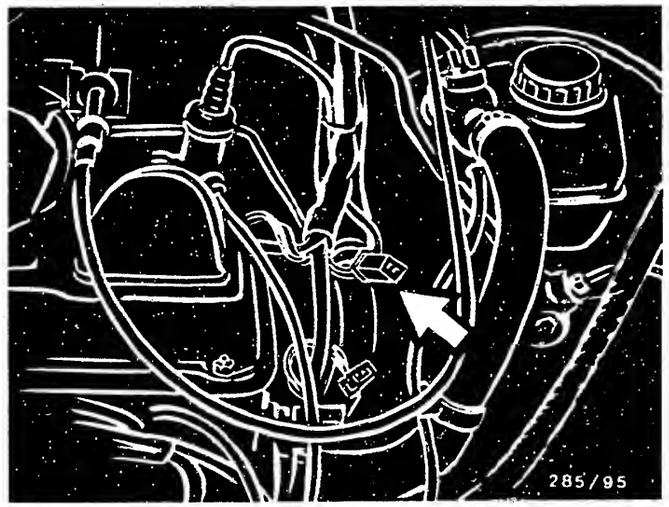
Activating actuator diagnosis:

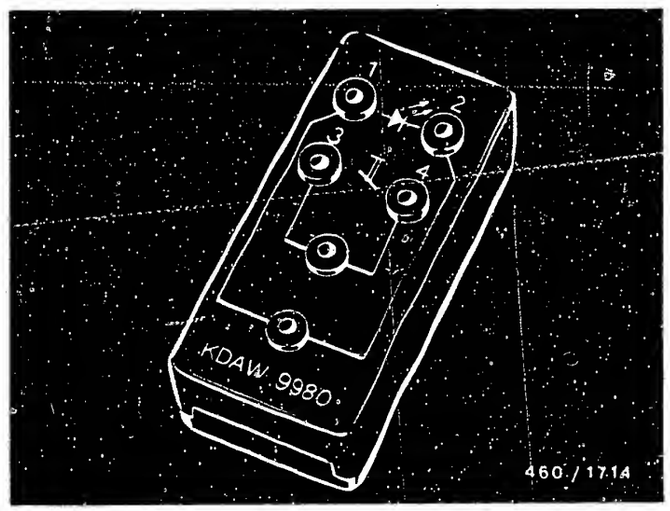
On vehicles with Bosch ignition trigger box additionally connect term. 7 of ignition trigger box to + 12 V.
Switch off ignition (min. 20 sek.).
Keep button on diagnosis evaluation unit pressed, switch on ignition.
Release button after more than 4 seconds.
With output of actuator diagnosis
(flashing code 4432, 4323, 4324, 4342 and 4343)
the corresponding actuators are simultaneously activated during flashing-code output and can be checked by listening to or feeling them (flashing code only indicates actuated component).

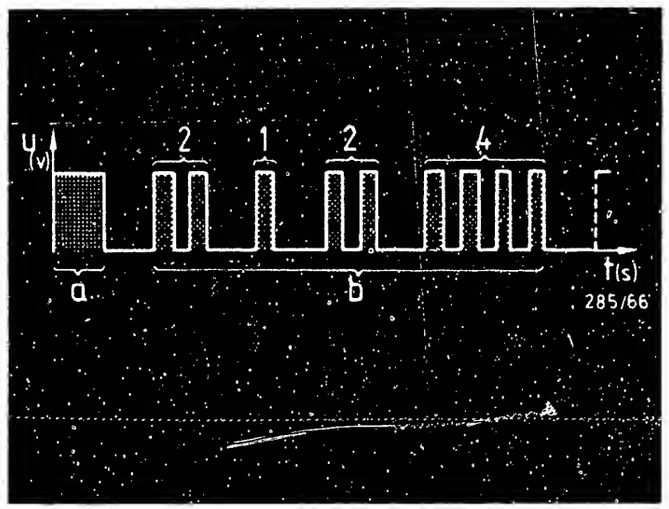
Note: Check TD signal if actuator diagnosis not possible.

Continuation of diagnosis:

Once a fault has been read out, the next fault is output or the next actuator activated by pressing the button again (more than 4 s).



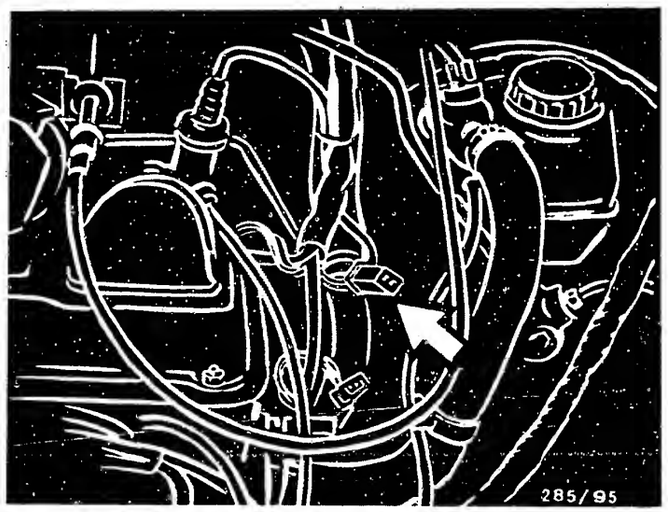




HOW TO USE SELF-DIAGNOSIS AND SELF-DIAGNOSIS TEST TABLE

N o t e :

The fault memory is cleared 15 seconds after switching off the ignition.
Should it not be possible to stimulate the control unit to provide diagnosis output, the voltage supply of the control unit and the diagnosis line from the control unit term. 6 to the diagnosis test coupling (free line in engine compartment, top picture, arrow) are to be checked for open circuit.
If there is no engine-speed signal, the LED lights brightly without button pressed on evaluation unit and the fault memory cannot be read out.



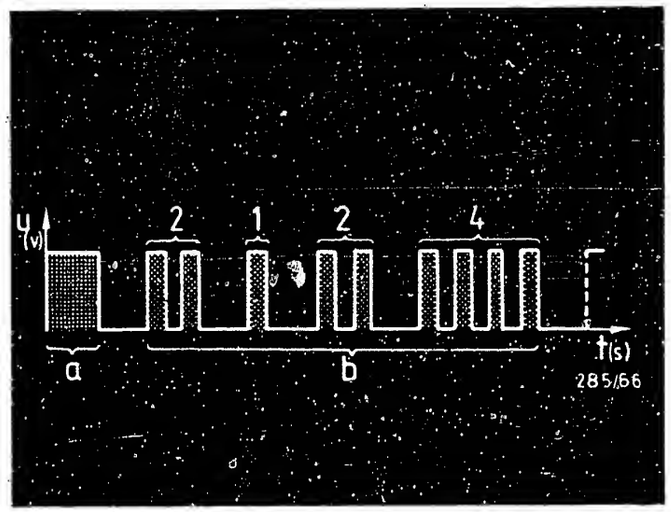
Flashing-code evaluation (center picture, b):

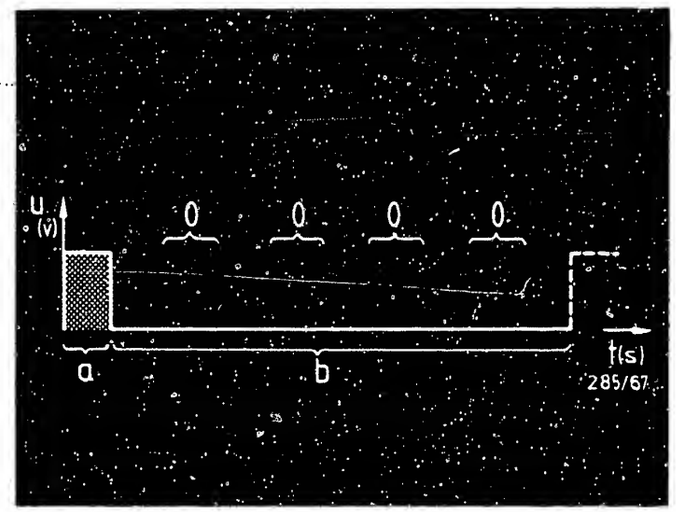
The flashing code for each fault consists of four flashing-pulse blocks.
Each block represents a number and features between 1 and 4 pulses.
One pulse corresponds to the number 1, whereas four pulses correspond to the number 4.
The fault lamp lights briefly with each pulse.

The interval between the blocks is longer than between the individual pulses.
Between two fault codes, continuation is effected by pressing the button again for more than 4 seconds.
The flashing code 4444 is output if there is no fault stored in the control unit.

If there is a fault stored in the control unit, the first fault (center picture, b) is output following the start signal.
If there is a further fault stored, its flashing code follows on effecting continuation by way of renewed short to ground.

Continuation must be effected until the flashing code 0000 (see bottom picture) indicates the end of self-diagnosis.
The fault memory is cleared when the ignition is switched off and the main relay is deenergized approx. 15 seconds later.





SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions / test conditions	Terminals	Set values
4444	Control unit	Control unit indicates that no fault is stored in the fault memory.	—	—
2214	Maximum speed exceeded	Maximum speed 7000 min $^{-1}$ was exceeded when driving. (Test speed limitation on chassis dynamometer).	25 2 12 12	6950 min $^{-1}$ –0,6...2,8 A
2124	Potentiometer in throttle-valve actuator. Short-circuit to ground or open-circuit.	Parallel resistance of potentiometer, throttle valve and throttle-valve actuator: Wiper resistance of potentiometer in throttle-valve actuator: (Actuate evacuating valve in throttle valve actuator during test and pull throttle-valve actuator back with manual vacuum pump). Resistance decreases constantly.	18 13 17 13 17 13	0,7...1,3 k Ω max: 1,4...2,4 k Ω min: less than 400 Ω
2212	Throttle-valve potentiometer. Short-circuit to ground or open-circuit.	Parallel resistance of potentiometer, throttle-valve and throttle-valve actuator: Wiper resistance of throttle-valve potentiometer: Allow engine to idle. Seal vented side of throttle-valve actuator. Switch off engine. Switch on ignition. Slowly depress accelerator pedal as far as it will go starting from idle position: Resistance constantly changes between min. and max.	18 13 11 13 11 13	0,7...1,3 k Ω max: 1,4...2,4 k Ω min: less than 270 Ω

SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/function	Test instructions / test conditions	Terminals	Set values
2312	Temperature sensor (coolant). Short-circuit to ground or open-circuit	Temperature-sensor resistance: at 20°C at 80°C	21 13 21 13	2,0...3,0 k Ω 280...360 Ω
2341	Lambda closed-loop control at closed-loop control limit	Test lambda closed-loop control and re-adjust closed-loop control range: Initiate indication of lambda closed-loop control range.	6	LED on evaluation unit flashes at 1,5 Hz
2342	Lambda sensor	Test lead from control unit term. 8 to plug connection of lambda sensor for short-circuit to ground or battery +: (Lambda-sensor plug connection detached) Test lead for open-circuit:	8 (-) 8 (+) 8	greater than 1M Ω greater than 1M Ω approx. 0 Ω
2412	Temperature sensor (intake air). Short-circuit to ground or open-circuit.	Temperature-sensor resistance: at 20°C at 80°C	5 13 5 13	2,0...3,0 k Ω 280...360 Ω
4432	Choke-valve actuator. Short-circuit to ground.	Test resistance of choke-valve actuator: Test insulation resistance of choke-valve actuator:	10 12 10 20	less than 10 Ω greater than 1 M Ω
2122	No TD signal	Test TD signal during starting process: Fault is only indicated if TD signal was present when engine was last started. (Only indicated as of control unit 0 285 007 042 ..043)	25 20	Rectangular pulses between 0 and 12 V
0000	End of diagnosis output	Control unit indicates that diagnosis output has been completed. Fault lamp flashes at 2,5 second intervals (start signal).	—	———

SELF-DIAGNOSIS TEST TABLE (continued)
Final-controlling-element diagnosis (component is activated by control unit during flashing-code output).

Flash code	Testing of components/function	Test instructions/Test conditions	Termin-als	Set values
4432	Choke-valve actuator	Choke-valve actuator is activated during diagnosis output. Insulation resistance of choke-valve actuator: Winding resistance of choke-valve actuator:	 10 12 10 12	 greater than 1M Ω less than 10 Ω
4343	Activated-carbon-filter bleeder valve	Final-controlling-element diagnosis: bleeder valve is actuated during flashing-code output. Insulation resistance Winding resistance	 15 2 15 23	 greater than 1 M Ω less than 100 Ω
4342	Relay for intake pre-heating	Final-controlling-element diagnosis: relay is actuated during flashing-code output. Insulation resistance Winding resistance	 14 2 14 23	 greater than 1 M Ω less than 100 Ω
4323	Ventilating valve in throttle-valve actuator	Final-controlling-element diagnosis: ventilating valve is actuated during flashing-code output. Insulation resistance, ventilating valve: Winding resistance, ventilating valve:	 9 2 9 23	 greater than 1M Ω 20...80 Ω
4324	Evacuating valve in throttle-valve actuator	Final-controlling-element diagnosis: evacuating valve is actuated during flashing-code output. Insulation resistance, evacuating valve: Winding resistance, evacuating valve:	 3 2 3 23	 greater than 1M Ω 20...80 Ω
0000	Diagnosis output complete	Control unit indicates that the diagnosis output is complete. Fault lamp flashes at 2,5 s. interval (start signal).	—	———

TEST SPECIFICATIONS:

Idle speed: 900±75 min $^{-1}$
Note: the idle speed is controlled and cannot be adjusted.

Engine-speed limitation 7000 min $^{-1}$

Exhaust-gas adjustment:
Test CO value at sampling pipe before catalytic converter: %CO by vol.0,2...1,0
To do this, hose for engine ventilation and lead to lambda sensor are disconnected.

Fuel pressure: 0,1...0,3 bar
Minimum fuel delivery (at 2000 min $^{-1}$) 1 l/min

Float weight: (dry) 7,9±0,5 g
Float height: 27,5±1,0 mm
(Float level cannot be adjusted)

Throttle-valve potentiometer
Total resistance: 1,4...2,6 k Ω
Wiper resistance in correcting range: min. less than 270 Ω
max. 1,4...2,4 k Ω

Choke-valve actuator.
Winding resistance: 0,9...1,7 Ω

Basic setting, throttle valve
Stage I (with feeler gauge) 3,15 mm
Stage II a = 0,03±0,02 mm

Release and forced return
Stage II: Y = 1,0±0,3 mm
Z = 0,4±0,2 mm

Float-chamber change-over valve
Winding resistance less than 50 Ω

Activated-carbon-filter bleeder valve
Winding resistance: 20...90 Ω

TEST SPECIFICATIONS (continued):

Choke-valve actuator
Evacuating valve (term. 1/2): 20...70 Ω
Venting valve (term. 6/7): 20...70 Ω
Total potentiometer resistance (term. 3/4): 1,4...2,6 k Ω
Wiper resistance in correcting range (term. 5/3): min. < 400 Ω
max. 1,4...2,4 k Ω

Temperature sensor (intake air)
Internal resistance at 20°C: 2,0...3,0 k Ω
at 80°C: 280...360 Ω

Heating element, intake-manifold heater:
Internal resistance at 20°C: approx. 0,25...0,5 Ω

Heating element, part-load channel:
Internal resistance at 20°C: approx. 1,5...2,5 Ω

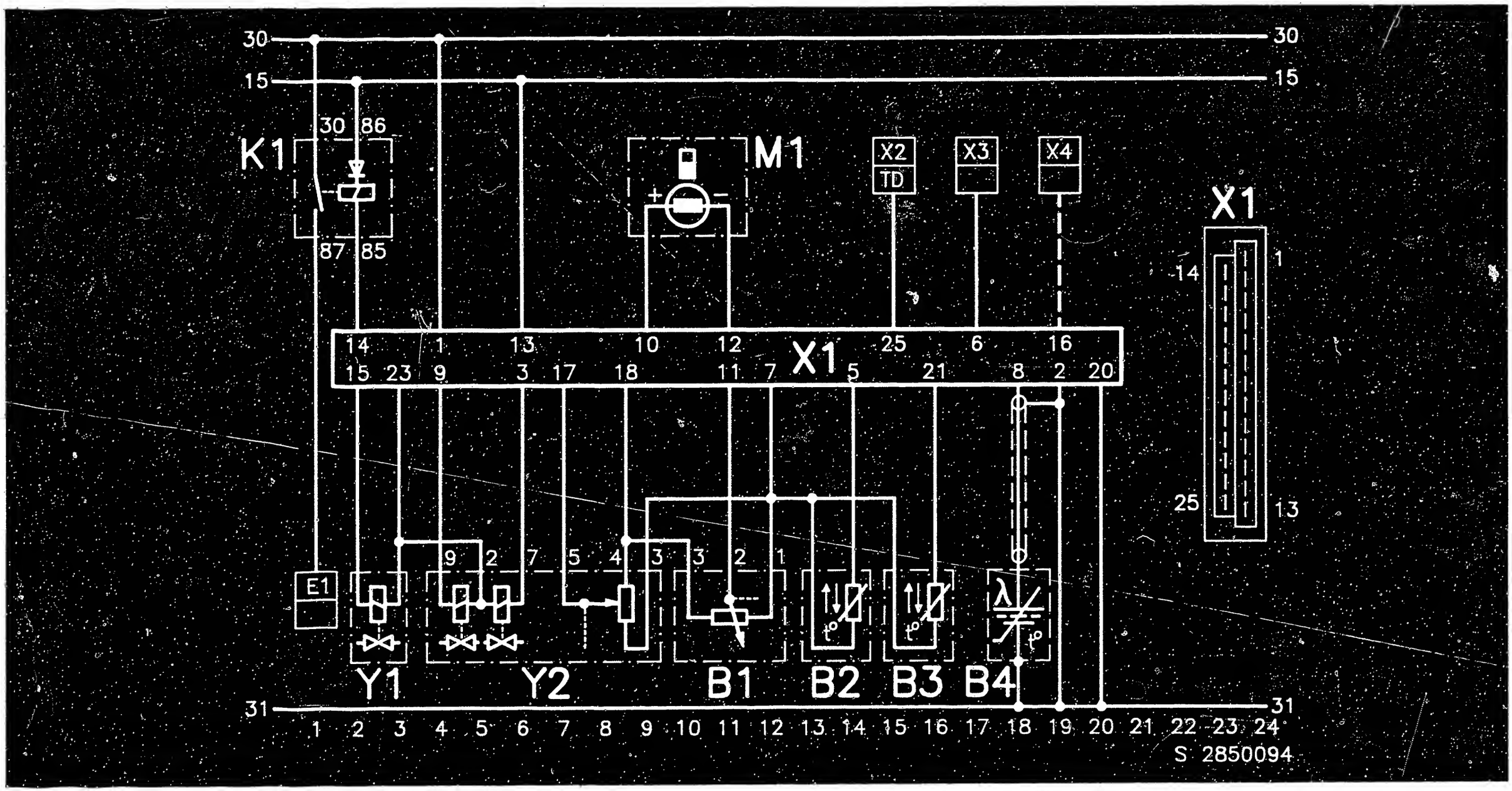
Nozzles:

	Stage 1	Stage 2
Main nozzle	x 105	x 110
Idle fuel nozzle	x 45	
Acceleration fuel nozzle		90
Air correction nozzle (with mixing pipe)	x 110	x 105
Acceleration air nozzle		x 130

Pipe for full-load enrichment
Height above pre-atomizer 13,5±1,0 mm

Tightening torques
Carburetor mount 7 Nm

Please refer to equipment and Autodata microcard for settings as regards valve clearance and other engine-related data.

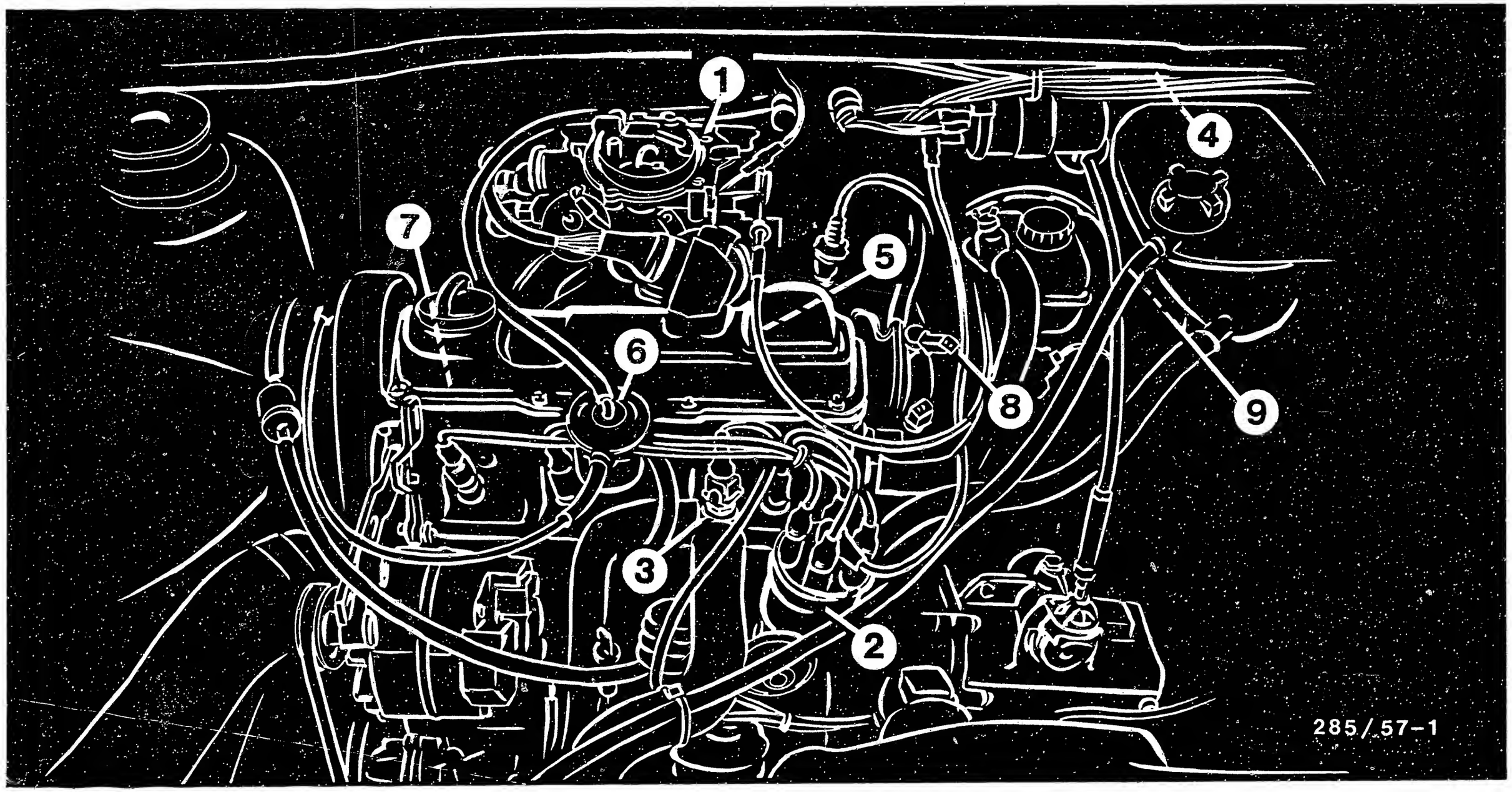


B1 = Potentiometer Main throttle valve
B2 = Temp. sensor, intake manifold
B3 = Temperature sensor, coolant
B4 = Lambda sensor
E1 = Intake-manifold heater
K1 = Relay, intake-manifold heater
M1 = Choke-valve actuator
X1 = Ecotronic control-unit plug
X2 = Plug, ignition trigger box
X3 = Diagnosis test coupling
X4 = Plug, transmission identifier
Y1 = ACF valve
Y2 = Throttle-valve actuator

ELECTRICAL TERMINAL DIAGRAM OF ECOTRONIC

J23 ⟹

J24 ⟸



1 = Carburetor
2 = Ignition distributor
3 = Temperature sensor Coolant
4 = Ecotronic control unit (under cover)
5 = Temp. sens., intake manifold
6 = Vapor bubble eliminator
7 = Sampling pipe for CO measurement
8 = Free lead for adjusting closed-loop control range of lambda sensor Lambda sensor is installed in flame tube
9 = ACF

INSTALLATION POSITION OF COMPONENTS

J25 — ⟹

J26 — ⟺

INSTALLATION POSITION OF COMPONENTS

The relay for the intake air preheating is located in the central fuse box on the left of the passenger compartment.

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Trouble-shooting instructions : VWW-5002

BOSCH system : Motronic ML 5.1 (Digifant)

Make of vehicle : Volkswagen

Basic microcard : KFZ-00.

TABLE OF CONTENTS

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

* VW Transporter
* VW Caravelle
* VW Multivan

2.1 l / 70 kW;	MV engine	08.85->
64 kW;	SR engine	10.86->
68 kW;	SS engine	09.89->

- Countries of application: Europe, USA

Features:

- Catalytic converter and lambda closed-loop control
- Crankshaft speed and crankshaft position are sensed via "Hall generator" (engine-speed and reference-mark sensor not present).
- Control unit with 25-pin connector
- External control unit of low-idle-speed control (not from BOSCH).
- To comply with more stringent noise regulations in the EC, the SS engine features cylinder-charge limitation effected by way of (pneumatic) closure of the second throttle valve at an engine speed of approx. 4500 1/min.
- Actuation of ignition coil by way of pulsed output stage
  Effect: Dwell angle approx. 70 %

* Construction, use:

These brief instructions essentially comprise vehicle-specific special features and test specifications (nominal values).

The trouble-shooting chart leads to various causes/component faults, depending on the customer complaint.
Detailed information for trouble-shooting can be found in the trouble-shooting chart of the basic instructions.

NOTE: Even when referring to the basic instructions, the nominal values, terminal assignments, and special features of these vehicle-specific brief instructions are always binding.

Identical test-step numbering facilitates the locating of individual test steps in the brief and basic instructions.

* Safety and preventative measures:

Do not expose persons to hazards.
Prevent damage to the engine, control unit, and ignition system.

C A R E F U L !
High-power ignition system.
Hazardous high and low voltages.

Do not touch voltage-carrying parts or terminals, as this can be fatal, on both the primary or secondary sides.

Make sure that fuel-injection does not take place during compression testing.
To ensure this, disconnect the pump relay.

For further safety measures, see the basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)
1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

1	2	3	4	5	6	7	8	9	10	11	Cause (component fault)
*											Voltage at control unit
*				*							Magnetic pulse generator
*		*			*	*					Fuel pressure
				*	*						Fuel delivery
*		*				*	*				Solenoid-operated injection valves
		*			*						Throttle valve
		*	*		*						Throttle-valve switch
		*									Overrun cut-off
	*	*	*								Idle actuator
		*									Idle speed, CO
*	*	*	*								Air-intake system
*	*	*	*	*	*	*					Air-flow sensor
					*	*					Temperature sensor (air)
*	*	*	*	*	*	*					Temperature sensor (engine)
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*	*	*	*		Spark-advance angle
		*	*	*							Interference-suppression resistors
				*	*						Interference
	*	*	*				*				Tank vent
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*		*	*		Control unit

RAPID DIAGNOSIS CHART

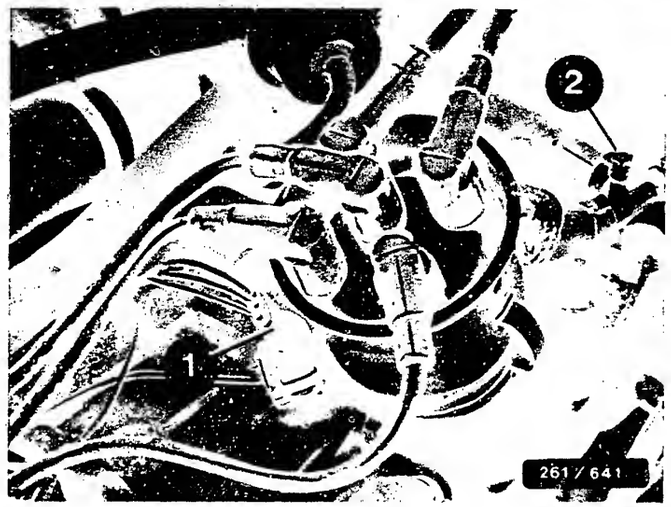
Test step	Testing of component/function	Test instructions/ Test conditions	Control-unit terminals	Set values
1	Leads to magnetic pulse generator (Hall generator)	Shift into neutral, switch off ignition, disconnect Digifant control unit, control unit of idle-speed control, and pump relay. Disconnect plug from ignition distributor and bridge all three connections. Measure resistance at open control-unit plug (25-pin) using test prods. Caution, do not damage spring contacts!	8<=> 6 and 18<=> 6	Less than 5 Ω
2	Temperature sensor (air). Resistance	At +15...+30°C	9<=> 6	1,45...3,3 k Ω
3	Temperature sensor (engine). Resistance	At +15...+30°C With engine at normal operating temperature:	10<=> 6	1,45...3,3 k Ω 280...360 Ω
4	Throttle-valve switch. Idle contact	Accelerator pedal not actuated: Slightly actuate accelerator pedal (part-load range):	11<=> 6	Less than 5 Ω Greater than 1 M Ω
5	Throttle-valve switch. Full-load contact	Fully depress accelerator pedal to floor (full-load stop): Slowly release accelerator pedal:	11<=> 6	Less than 5 Ω Greater than 1 M Ω
6	Air-flow sensor (potentiometer). Resistance		17<=> 6	500...1100 Ω
7	Air-flow sensor (potentiometer wiper). Resistance	Slowly deflect air-flow sensor flap as far as it will go	21<=> 6	8...2500 Ω
8	Injection valves (4) and lambda-sensor heating	At +15...+30°C Note: only one injection valve connected at one time	12<=>14	each 20...25 Ω
9	Lead to lambda sensor	Pull apart single plug-in connection to lambda sensor: Apply lambda input (green lead to control unit) to ground:	2<=>13	Greater than 1 M Ω Less than 5 Ω
10	Heating winding of lambda sensor		14<=>13	1...15 Ω (temperature-dependent)

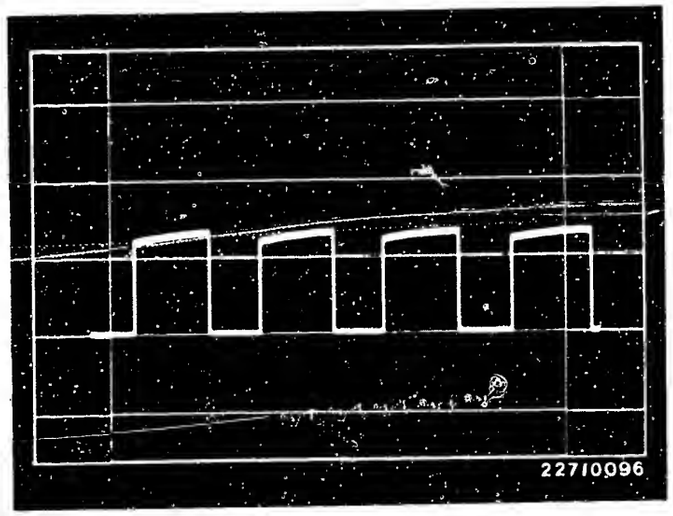
K05 ⟹

K06 ⟺

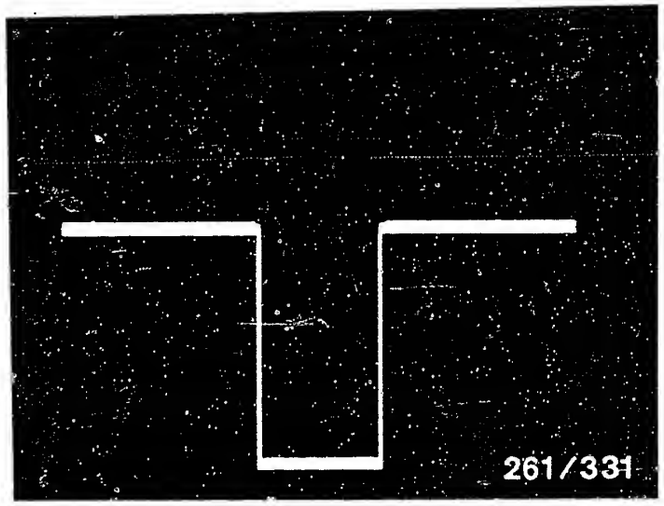
RAPID DIAGNOSIS CHART (Continued)

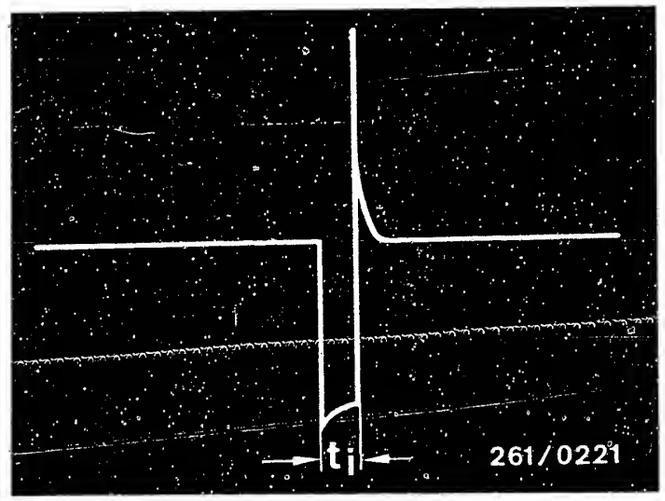
Test step	Testing of component/function Test instructions/conditions	Control-unit terminals	Set values
11	Voltage measurement, switch over measuring range! Main relay + instrument leads. Voltage supply for control unit. Switch on ignition.	14<=>13 and 14<=>19	10...15 V
12	Pump relay + instrument leads. Activation of electric fuel pump. Ignition switched on.	3<=>13	10...15 V
13	Fuel pressure. Switch off ignition; connect pressure gauge (upper illustration, item 2). Switch on ignition.. Bridge term. 3 and term. 13 in control-unit plug (electric fuel pump must begin to run audibly).		2,3...2,7 bar
14	Lead to term. 50 (starting motor). Start signal. Shift into neutral and start.	1<=>13	8...15 V
15	Ignition coil (primary winding) with instrument leads to term. 15 and term. 1. Switch on ignition.	25<=>13	10...15 V
16	Digifant control unit. Voltage supply for magnetic pulse generator. Connect control unit, push back rubber sleeve of plug at ignition distributor (upper illustration, item 1). Measure voltage at the two outer leads (+ and –) using test prods. Switch on ignition.	8<=> 6	10...15 V
17	Magnetic pulse generator. Switching function Switching operation as before, however, with oscilloscope (special input) at center connection (0) and vehicle ground, test voltage characteristic. Start engine.	18<=> 6	See lower illustration.

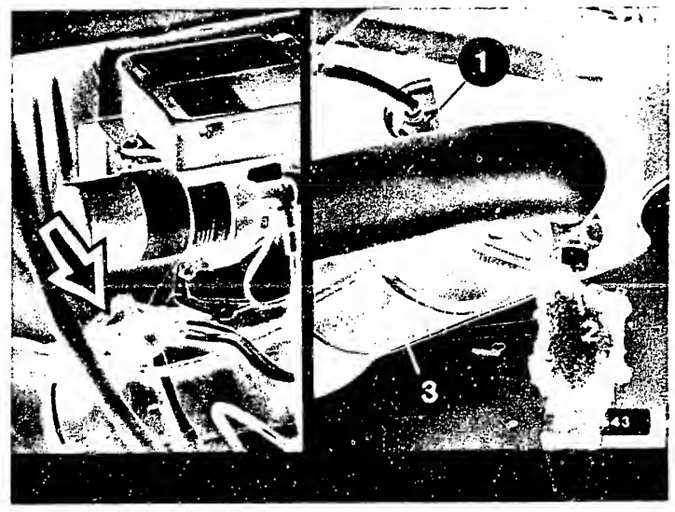




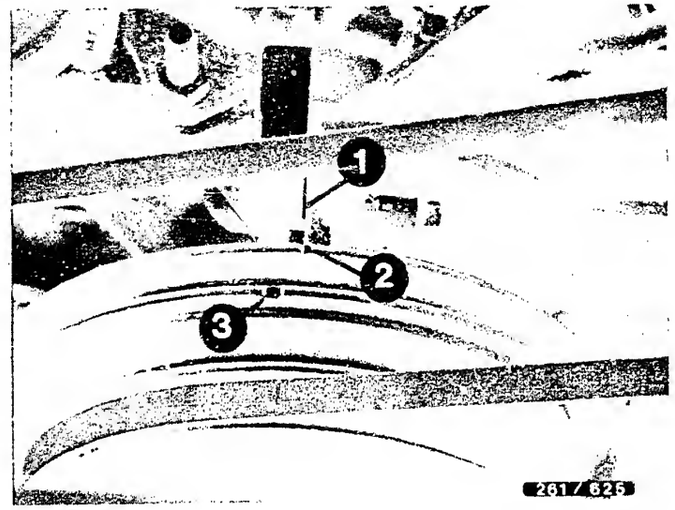
Test step	Testing of component/function Test instructions/conditions	Control-unit terminals	Set values
18	Dwell-period signal. Using oscilloscope (special input), test at ignition coil term. 1 Shift into neutral and start.	25<=> 6	See upper illustration
19	Injection signal. Using oscilloscope, test directly at injection valve (test lead 1 684 463 093). Shift into neutral and start. Duration of injection dependent upon engine temperature (NTC II). With engine running, <u>briefly</u> disconnect plug from engine-temperature sensor.	12<=> 6	See center illustration Duration of injection becomes longer (observe oscilloscope)
20	Voltage supply, air-flow sensor. Push back rubber sleeve on air-flow sensor plug and measure voltage between connections 3 and 4 using test prods. Switch on ignition.	17<=> 6	> 4,5 V
21	Air-flow sensor (wiper). Load signal. As above, however, measure between connections 2 and 4.	21<=> 6	Air-flow sensor flap in rest position: 0,2...0,3V Air-flow sensor flap fully deflected: > 4,2 V
22	Idle speed and CO. Connect motortester and CO analyzer (sample pickup in front of catalytic converter; lower illustration, Item 2). Disconnect single plug-in connection of lambda sensor (lower illustration, arrow) and of idle actuator before measuring.		830...930 min $^{-1}$ 0,3...1,1 % CO by vol.

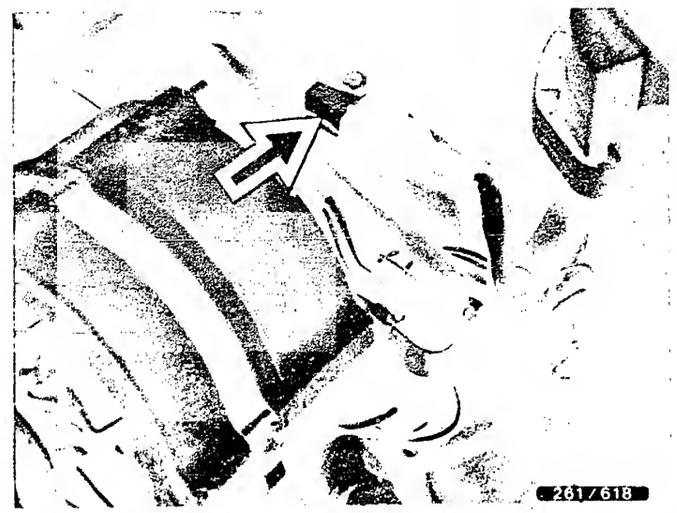


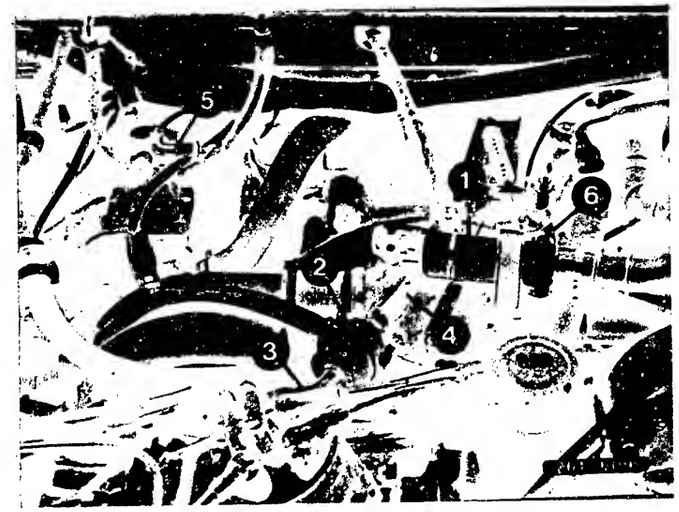




Test step	Testing of component/function Test instructions/conditions	Control-unit terminals	Set values
23	Test spark advance (basic value). Engine at normal operating temperature, plug of temperature sensor (engine) <u>disconnected</u>, engine speed 2000...2500 min $^{-1}$. Upper illustration: 1 = Reference edge 2 = Ignition marking 5° crankshaft 3 = TDC		Basic value: 3...7 °crankshaft
	<u>Connect</u> plug of temperature sensor (engine); Engine speed approx. 3000 min $^{-1}$. Subtract the basic value from spark advance indicated and determine adjustment value:		Adjustment value: 30...40 °crankshaft
24	Overrun cut-off. Pull apart plug connection to throttle-valve switch and bridge in plug on control-unit side (center illustration, arrow). Start engine (normal operating termperature) and accelerate slightly. Note: accelerating first and then bridging the plug is also possible.		Engine hunts
25	Low-idle-speed control. Measure idle-actuator current. Idle speed, engine at normal operating temperature, consuming devices switched off, disconnect hose for crankshaft ventilation from oil vent and seal off. Disconnect single plug-in connection (lower illustration, Item 5): Connect single plug-in connection: Switch on consuming devices (e.g. headlamps, air conditioner, etc.):		Approx.430 mA Approx. 430 mA fluctuating Depending upon load 430...1000 mA

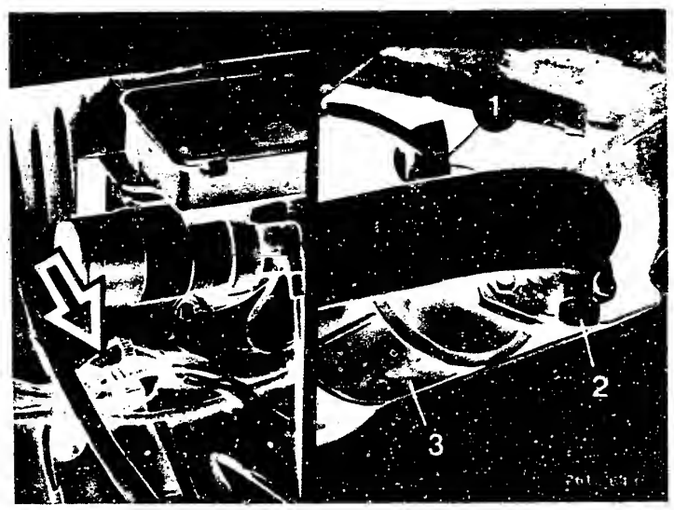


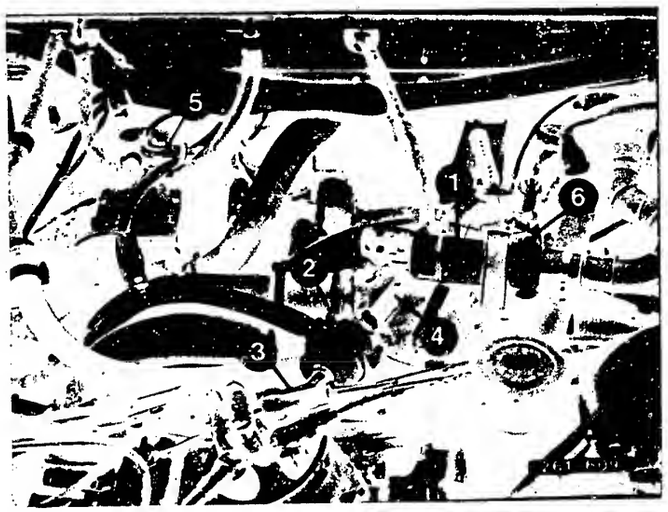




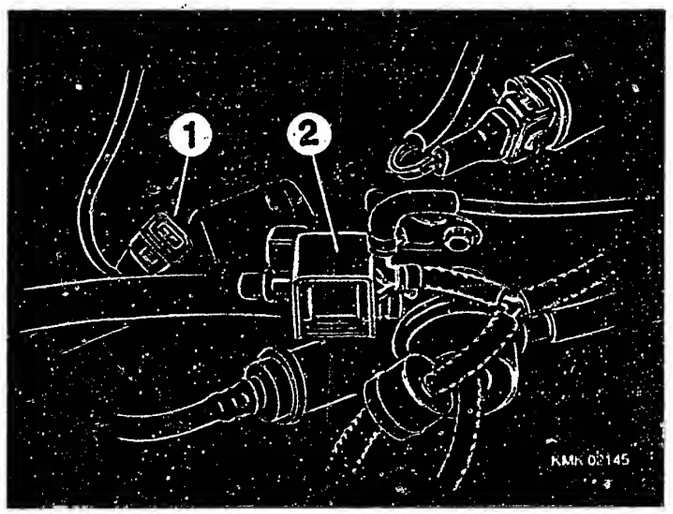
RAPID DIAGNOSIS CHART (Continued)

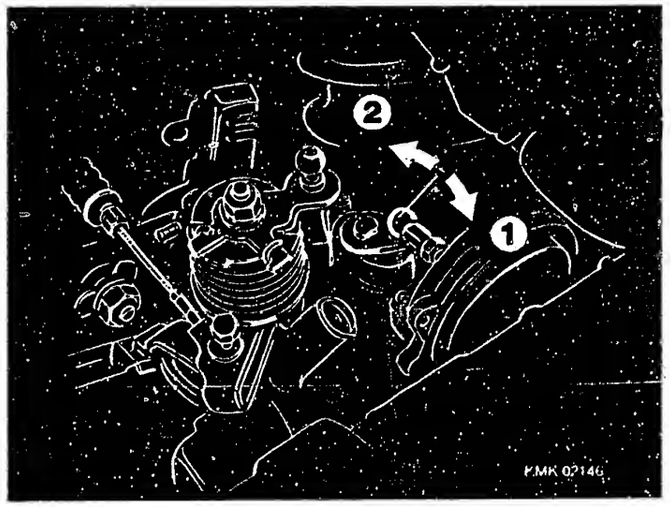
Test step	Testing of component/function Test instructions/conditions	Control-unit terminals	Set values
26	Lambda-closed-loop control upper limit. Connect CO analyzer in front of catalytic converter. Idle speed; engine and catalytic converter at normal operating temperature; disconnect plug-in connection to lambda sensor (upper illustration, left - arrow) and apply connection on control-unit side (lambda input) to ground. Upper illustration, right: 1 = Lambda sensor 2 = CO connection 3 = Catalytic converter		CO increases to above 1,1 % by vol. (Carry out test step quickly)
27	As Test step 26, however, test lambda closed-loop control lower limit. Lambda input to approx. +2 V, e.g. to positive terminal of a 1.5 V monocell (connect negative terminal to vehicle ground).		CO falls below 0,3 % by vol. (rough idling)
28	Control unit and lambda sensor in closed-loop control mode. Plug-in connection to lambda sensor connected; run engine (at normal operating temperature) at idle; note down CO value: Disconnect air hose from fuel-pressure regulator and seal off (lower illustration, item 3).		CO= 0,3...1,1% by vol. CO increases briefly and drops back to control value specified above





Test step	Checking of component/function Test instructions/conditions	Contr.-unit terminals	Set values
29	Function, 2-way valve (picture, top right) Connect up Motortester for engine-speed measurement with ignition OFF; detach connector (1) from 2-way valve (2) and connect up voltmeter; ignition ON; measure voltage.		10...15 V
30	Function, control unit for engine-speed limitation: Start engine, increase engine speed and, whilst doing so, observe position of pushrod (picture, bottom left) between vacuum unit and throttle lever.		up to approx. 4500 1/min arrow 1 (throttle valve open) over 4500 1/min arrow 2 (throttle valve closed)





Idle speed: 830...930 min $^{-1}$

Exhaust-gas setting
* CO value with engine at normal operating temperature: 0,3...1,1 % by vol.

Pressure regulator
* Fuel pressure: 2,3...2,7 bar

Electric fuel pump
* Fuel delivery (measured in return line) at least 500 cm ^{3} /30s

Supply voltage (under load): at least 12 V

Temperature sensor (engine)
Internal electrical resistance at

* Ambient temperature (+15°C...+30°C): 1,45...3,3 k Ω

* With engine at norm. op. temp. (approx. +80°C): 280...360 Ω

Solenoid-operated injection valve:
Internal electrical resistance at
* Ambient temperature (+15°C...+30°C): 15...17,5 Ω

Idle actuator
(not from Bosch)
* Internal electrical resistance: approx. 4 Ω

Air-flow sensor

* Internal electrical resistance
between term.2 and term.4: 8...2500 Ω (1)
term.3 and term.4: 500...1100 Ω

(1) = (Deflect air-flow sensor flap as far as it will go).

Temperature sensor (intake air)

* Internal electrical resistance measured at air-flow sensor between term.1 and term.4 at ambient temperature (+15°C...+30°C): 1,45...3,3 k Ω

Ignition coil

* Primary resistance (term.1/term.15): 0,5...0,8 Ω
* Secondary resistance (term.1/term.4) : 2,4...3,5 k Ω

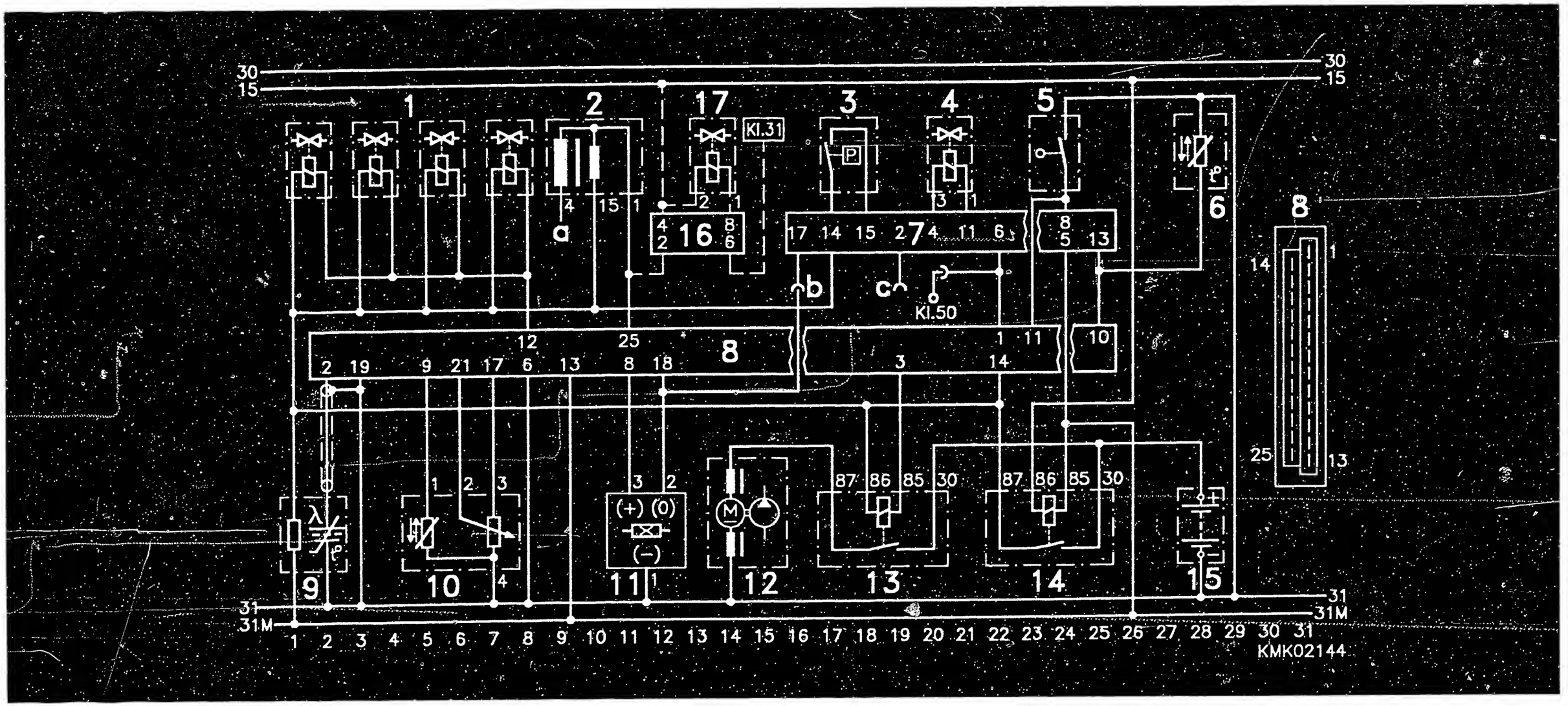
Lambda-sensor heater winding: 1...15 Ω

Interference-suppression resistors

* Ignition-distributor rotor: 0,6...1,4 k Ω
* Distributor cap : 0,6...1,4 k Ω
* Spark-plug connector : 4... 6 k Ω

Vacuum unit and vacuum vessel (SS engine only)

* Vacuum: mbar
must not drop off within 2 minutes

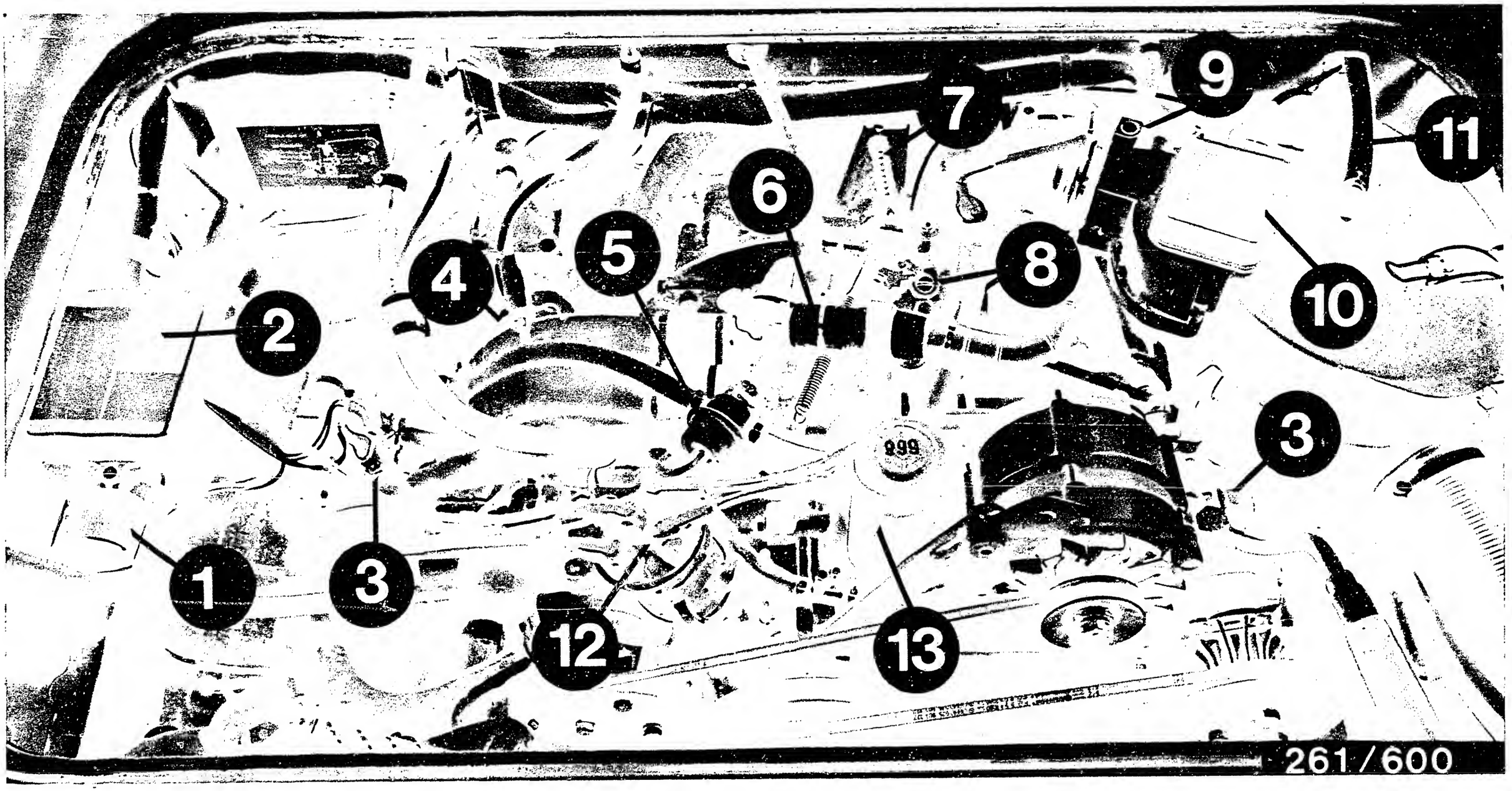


ELECTRICAL TERMINAL DIAGRAM

1 = Solenoid-operated injec. vlv.
2 = Ignition coil
a = to high-voltage distributor
3 = Pres.-switch pwr.-asst. steer.
4 = Idle actuator
5 = Throttle-valve switch
6 = Temperature sensor (engine)
7 = Idle controller
b = Plug-in connection
c = Test connection
8 = Control-unit plug
9 = Lambda sensor (heated)
10 = Air-flow sensor
11 = Magnetic pulse generator (Hall generator)
12 = Electric fuel pump
13 = Pump relay
14 = Main relay
15 = Battery
16 = Control unit for eng.-speed limitation
17 = 2-way valve for eng.-speed limitation

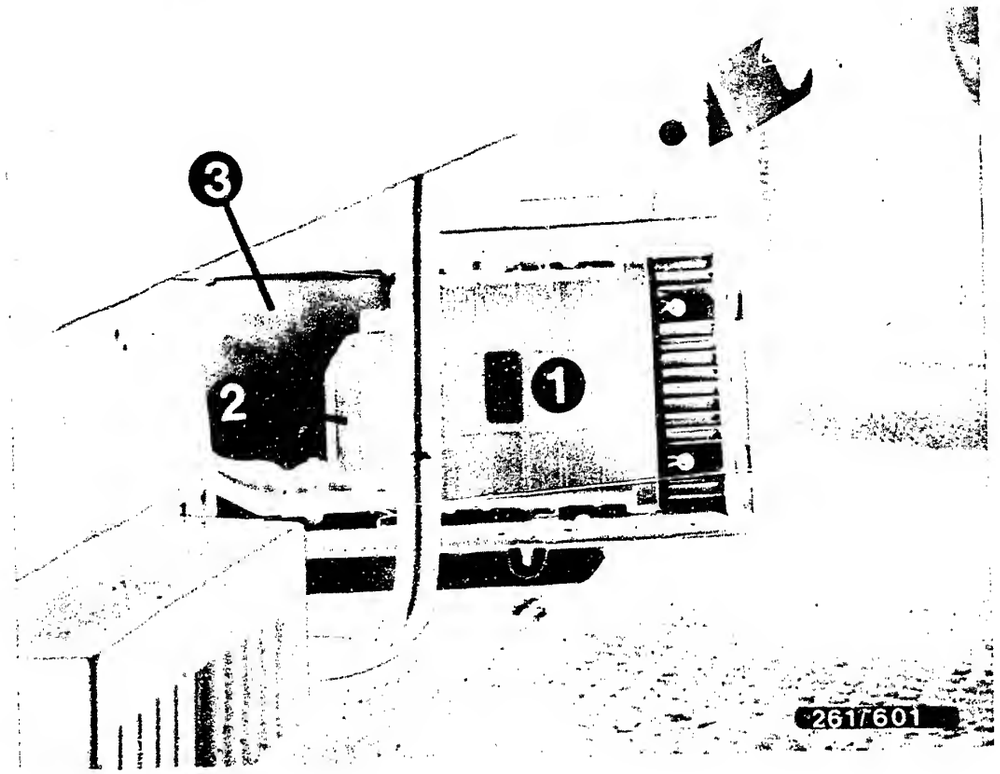
16 and 17 Engine code letters SS only

K19 —⟹
K20 ⟸—



INSTALLATION POSITION OF COMPONENTS

1 = Ignition coil
2 = Main and pump relays
3 = Injection valves
4 = Temperature senosr (engine)
5 = Pressure regulator
6 = Idle actuator
7 = Throttle cable
8 = Idle-speed adjusting screw
9 = CO adjusting screw
10 = Air-flow sensor
11 = Hose to active carbon canister (tank ventilation)
12 = Ignition distributor
13 = Oil vent



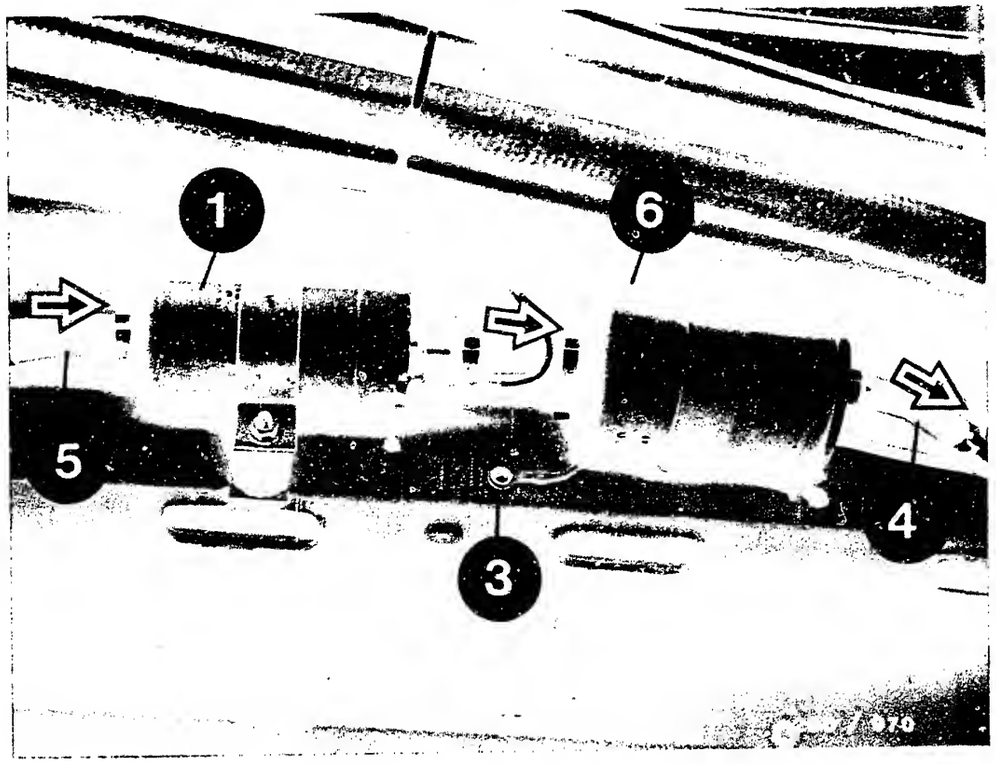
1 = Control unit
2 = 25-pin plug
3 = Sheet-metal cover

INSTALLATION POSITION OF COMPONENTS (continued)

The indications "right" and "left" always refer to the forward direction of travel.

Control unit:
Beneath the rear seat bench (remove footwell covering and unscrew control unit together with sheet-metal cover from floor pan).

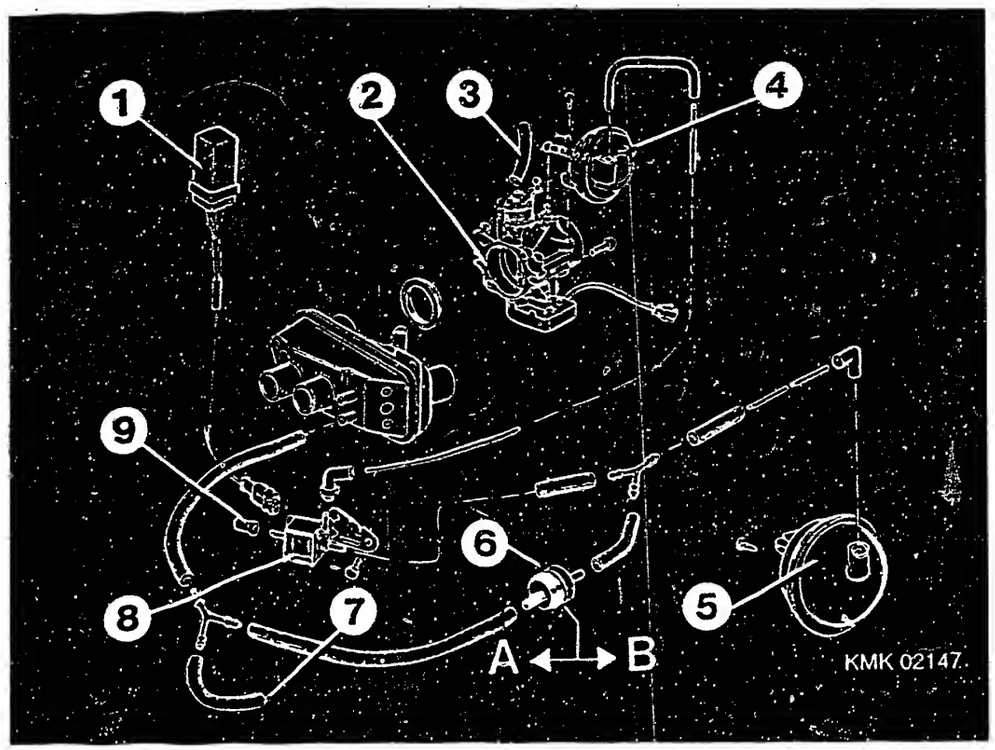
Fuel pump and fuel filter:
beneath the vehicle (approx. center of floor pan).



1 = Electric fuel pump
3 = Ground connection of electric fuel pump
4 = Fuel delivery line
5 = Fuel intake line
6 = Fuel filter
Arrow = Direction of fuel flow

INSTALLATION POSITION OF COMPONENTS (cont.)

There is also a fuel-intake filter in the fuel intake line (before the electric fuel pump).



Speed limitation system (SS engine only)

1 = Control unit for engine-speed limitation
(in relay unit in engine compartment)

2 = Throttle-valve assembly
3 = Line to tank ventilation valve

4 = Vacuum unit
5 = Vacuum vessel

6 = Non-return valve
(arrow A = throughput
arrow B = no throughput)

7 = To fuel-pressure regulator

8 = 2-way valve
(ignition ON:
throughput in all tubes)
(ignition OFF: tube for line to junction
piece has no throughput)

9 = Vent cap

Blank page for production reasons!

T A B L E O F C O N T E N T S

Trouble-shooting instructions : OPE-5002

BOSCH system : Ecotronic

Make of vehicle : 2 Z

Basic microcard : OPEL

SPECIAL FEATURES

* This microcard contains the ECO2Z trouble-shooting instructions, valid at the time of publication, for the following Opel models:

  Ascona/Kadett 1,8S (10.86 ->)
  (with S 18 NV and E 18 NV engine)

* Ecotronic with integral characteristic-map ignition (ECO2Z) with 35-pin control unit.

* The control unit is equipped with self-diagnosis. If a fault should arise in the system, it is stored in the fault memory. At the same time, the warning/diagnosis lamp in the instrument panel lights up. If a sensor fails, the control unit operates with specified substitute values.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.
Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier through the use of identical test-step numbers.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

* C A U T I O N !
High-performance ignition system.
Dangerous primary and secondary voltages.

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For further precautionary measures, see basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel induction).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Evaluate self-diagnosis
										*	Fault lamp defective
*			*	*							Engine-speed/reference-mark sensor
*											Test primary side
*		*	*	*	*	*					Test secondary side
							*	*			Poor fuel quality
*			*	*	*						Fuel pressure
	*			*	*						Fuel filter
*	*	*	*	*	*	*					Choke-valve flap
*	*			*	*						Float/float-needle valve
*	*	*	*	*	*						Dirt in carburetor
	*	*	*	*	*						Intake system leaking
	*	*									Intake-manifold heating
	*	*									Intake-air preheating
				*							Alternator, interference-suppress.
		*	*								Bypass heating

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel induction).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
	*				*						Adjustment, throttle valve stage I
	*	*	*	*	*						Incorrect type of nozzle
		*		*							Vacuum unit, stage II
	*	*		*							Adjustment, throttle valve stage II
		*		*	*						Adjustment, accelerator actuation
	*										Idle CO adjustment
	*	*									Throttle valve worn
							*	*			Test octane-rating adaptation
		*									Release and forced return

For production reasons: continued on the following coordinate.

SELF-DIAGNOSIS TEST TABLE

Fault indication Flash code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1 2	Control unit, diagnosis output	Control unit indicates that it is in the diagnosis mode.	30	—
1 4	Coolant-temperature sensor (short circuit to ground)	Resistance of temperature sensor: at 20°C at 80°C	13 23 13 23	2...3 k Ω 280...360 Ω
1 5	Coolant-temperature sensor (open circuit)			
2 2	Throttle-valve potentiometer (short circuit to ground and/or open circuit)	Resistance, throttle-valve potentiometer and throttle-valve actuator (parallel): Wiper resistance, throttle-valve potentiometer: Run engine at idle. Seal off ventilating side of throttle-valve actuator. Switch off engine. Switch on ignition. Accelerator pedal in idle position: Accelerator pedal in full-load position: Resistance changes constantly between min. and max.	9 6 9 7 9 7	0,7...1,3 k Ω min. less than 270 Ω max. 1,4...2,4 k Ω
4 1	Intake-manifold temperature (short circuit to ground)	Resistance of temperature sensor: at 20°C at 80°C	22 23 22 23	2...3 k Ω 280...360 Ω
4 3	Intake-manifold temperature sensor (open circuit)			
4 8	Supply voltage too low		4 5 + −	greater than 10 V
4 9	Supply voltage too high	Test alternator/alternator regulator	4 5 + −	less than 15 V
5 1	Control unit defective	After all faults have been read out. Clear fault memory. Run engine briefly. Repeat self-diagnosis output. If a fault is indicated again, replace the control unit.	—	—

SELF–DIAGNOSIS TEST TABLE (Continued)

Fault indication Flash code	Testing of component/functions	Test instructions/Test conditions	Termi-nals	Set values
5 3	Potentiometer in throttle–valve actuator (open circuit)	Resistance, throttle–valve potentiometer and throttle–valve actuator (parallel): Wiper resistance, potentiometer in throttle–valve actuator: (activate evacuating valve in throttle–valve actuator while testing and pull back throttle–valve actuator with hand vacuum pump.) Resistance decreases continously.	9 6 28 6 28 6	0,7...1,3 k Ω min. less than 400 Ω max. 1,4...2,6 k Ω
5 4	Potentiometer in throttle–valve actuator (short circuit to ground)			
5 6	Choke–valve actuator, current too high	Insulation resistance of choke–valve actuator:	14 5	greater than 1 M Ω
5 7	Choke–valve actuator, current too low	Winding resistance of choke–valve actuator:	14 15	0,9...1,7 Ω
5 8	Input for CO adjustment (short circuit to ground)	Insulation resistance, input for CO adjustment: (adjustment plug disconnected)	10 5	greater than 1 M Ω
5 9	Throttle–valve actuator extends too slowly	Fault is indicated only if engine is running at idle during diagnosis output.		
6 1	Throttle–valve actuator retracts too slowly	Switch off engine and check time it takes throttle–valve actuator to extend/retract: Retraction: Extension:	—— ——	max. 1 s max. 1 s
6 2	Ventilating valve in throttle–valve actuator	Insulation resistance, ventilating valve: Winding resistance, ventilating valve:	34 5 34 35	greater than 1 M Ω 20...70 Ω
6 3	Evacuating valve in throttle–valve actuator	Insulation resistance, evactuating valve: Winding resistance, evacuating valve:	33 5 33 35	greater than 1 M Ω 20...70 Ω

TEST SPECIFICATIONS:

Idle speed:	830 ± 50 min-1
with idle-speed increase	930 ± 50 min-1
CO adjustment:	
CO value with engine at normal operating temperature	0,2...0,3 % CO by vol.
With CO adjustment plug plugged in	0,5...1,5 % CO by vol.
Fuel pressure:	0,1...0,3 bar
Minimum fuel delivery (at 2000 min-1)	1 l/min
Float weight:	8,3 ± 0,3 g
Float height:	27,5 ± 1,0 mm

(Float level cannot be adjusted

Throttle-valve potentiometer

Total resistance:	1,4...2,6 k Ω
Wiper resistance in correcting range: min.	less than 270 Ω
max.	1,4...2,4 k Ω

Choke-valve actuator:	
Winding resistance:	0,9...1,7 Ω
Basic setting, throttle valve Stage II:	a = 0.05 ± 0,02 mm
Release and forced return Stage II:	Y = 0,4 ± 0,3 mm
	Z = 0,3 ± 0,2 mm
Tightening torques Flange mounting	9 Nm

TEST SPECIFICATIONS (continued):

Throttle-valve actuator

evacuating valve (term.1/term.2):	20...70 Ω
ventilating valve (term.6/term.7):	20...70 Ω
Total resistance, potentiometer (term.3/term.4):	1,4...2,6 k Ω

Wiper resistance in correcting range (term.5/term.3):
min. less than 400 Ω
max. 1,4...2,4 k Ω

Inductive engine-speed and reference-mark sensor:
Internal resistance 0,5...0,3 k Ω

Temperature sensor (NTC):

Internal resistance at 20°C:	2...3 k Ω
at 80°C:	280...360 Ω

Heating element, intake-manifold heating:
Internal resistance at 20°C: 0,6...0,7 Ω

Heating element, bypass heating:
Internal resistance at 20°C: 1,4...2,1 Ω

Type of nozzle:

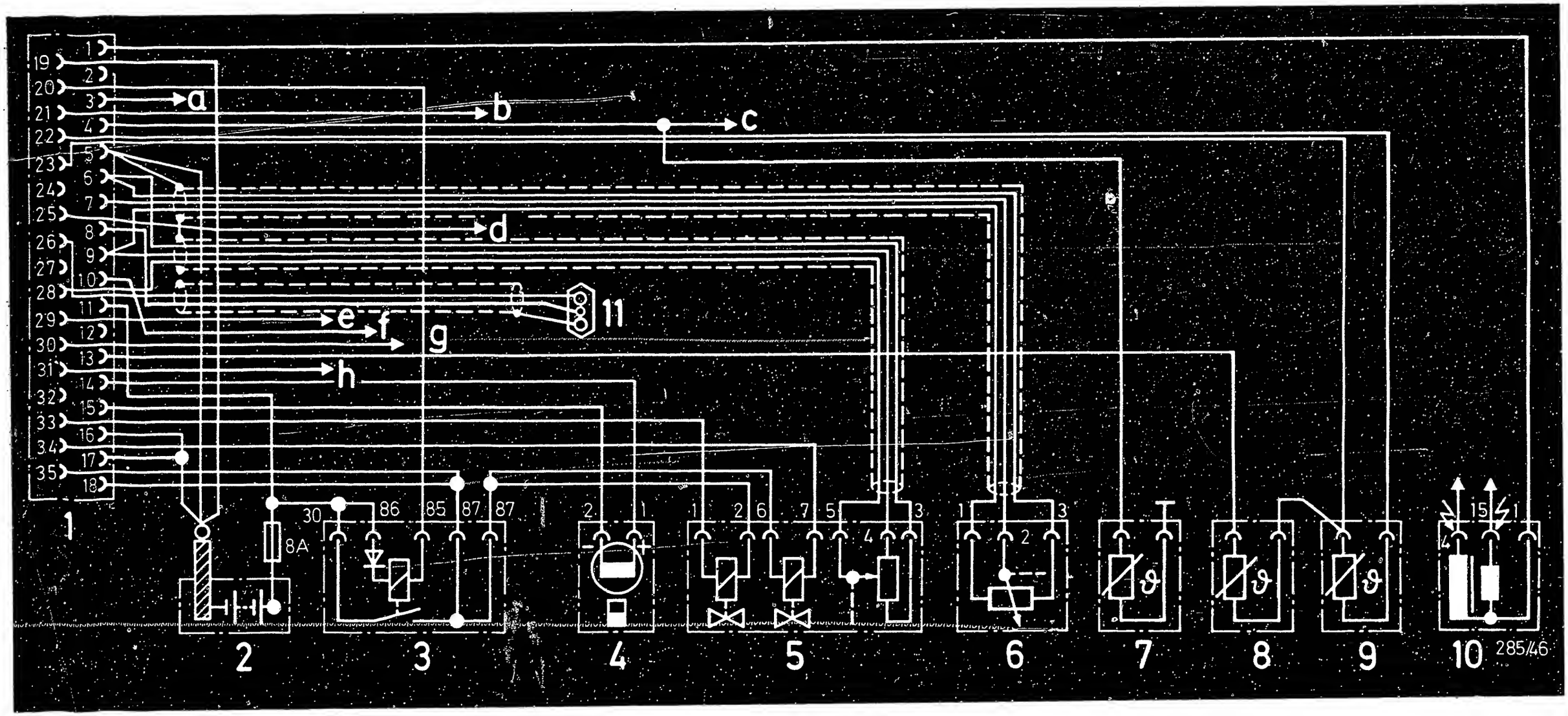
	Stage 1	Stage 2
Main nozzle	x 110	x 135
Idle fuel nozzle	x 52,5	
Air-correction nozzle	x 110	x 70

Coding plug, octane-rating adaptation:

Resistance at:
91 RON: infinity Ohms
95 RON: 0 Ω

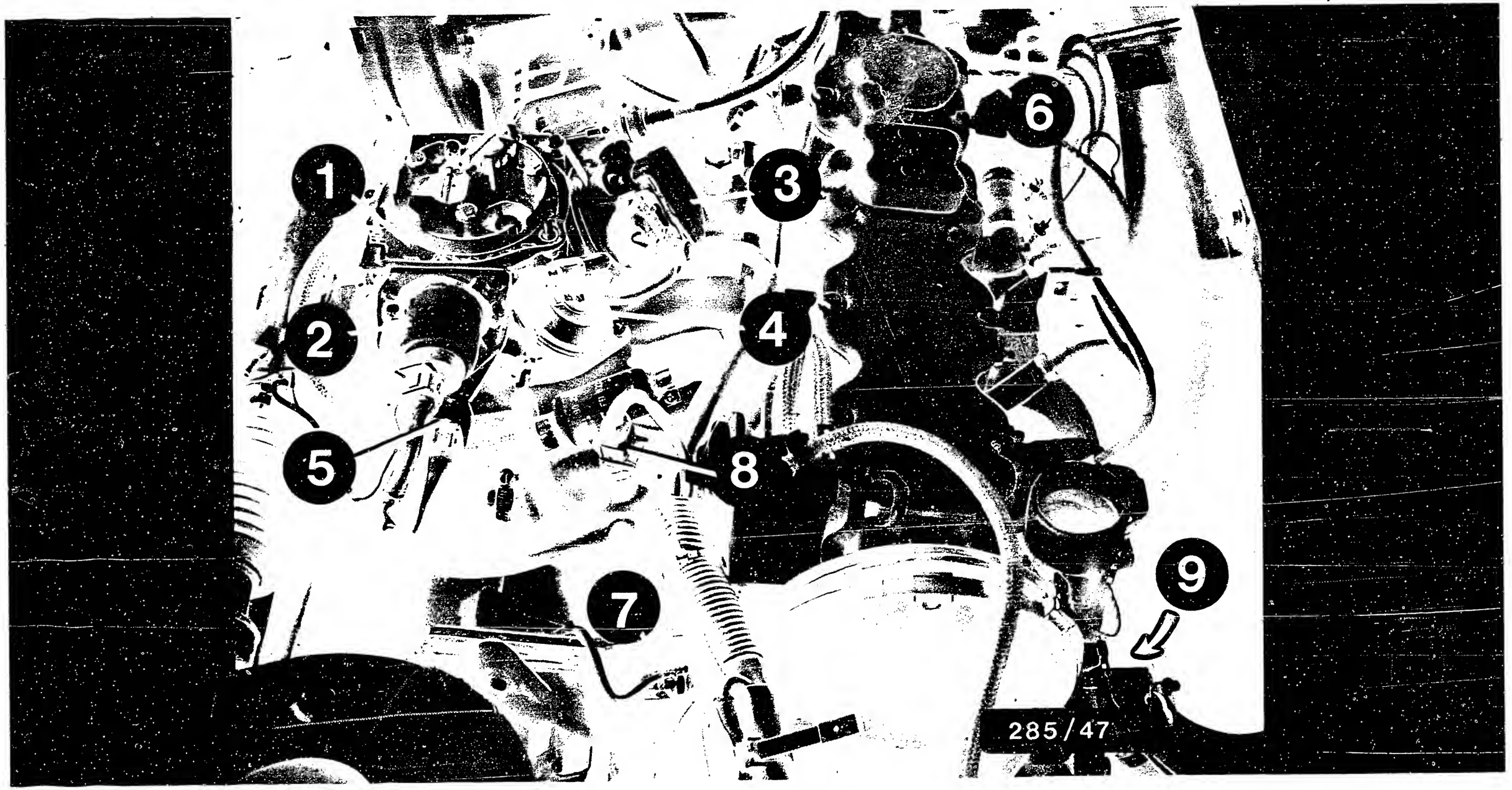
Voltage supply for potentiometer (throttle valve and throttle-valve actuator) and temperature sensor:
4,5...5,5 V

See equipment and Autodata microcards for the setting values for valve clearance and other engine-related data.



ELECTRICAL TERMINAL DIAGRAM

1 = Control unit,Ecotronic with ign.
2 = Battery
3 = Control relay
4 = Choke-valve actuator
5 = Throttle-valve actuator
6 = Potentiometer, main throttle valve (HD pot)
7 = Bypass heating element
8 = Coolant-temperature sensor
9 = Intake-manifold temp. sensor
10 = Ignition coil
11 = Reference-mark sensor
a = To intake-man. heating relay
b = TD output
c = To central electrics
d = Octane-rating adaptation
e = Idle-speed increase (with increase to ground)
f = Input for CO adjustment
g = Diagnostic lamp
h = Diagnosis stimulation lead

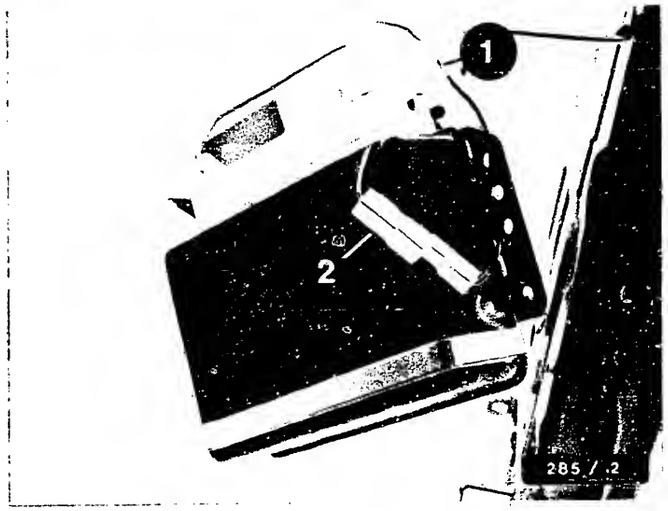


INSTALLATION POSITION OF COMPONENTS

1 = Carburetor
2 = Choke-valve actuator
3 = Throttle-valve actuator
4 = Vacuum unit stage 2
5 = Throttle-valve potentiometer
6 = High-voltage distributor
7 = Coolant-temperature sensor
8 = Intake-manifold temp. sensor
9 = Reference-mark sensor

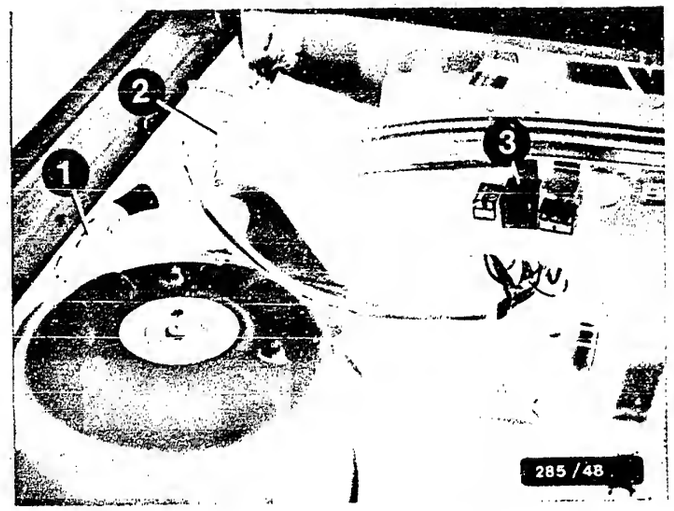
INSTALLATION POSITION OF COMPONENTS (Continued)

The Ecotronic control unit with integral ignition is installed in the right-hand footwell beneath the cover (upper illustration). The cover has already been removed in the illustration.
For the purpose of octane-rating adaptation, a coding loop has been installed in the wiring harness in vehicles with the S 18 NV engine (upper illustration, 1), and a coding plug has been installed in the engine compartment on the right-hand side behind the spring-strut dome in vehicles with the E 18 NV engine.
The engine speed can be increased by approx. 100 min $^{-1}$ via this plug connection (upper illustration, arrow 2).



The diagnostic plug is located in the engine compartment on the right-hand side behind the spring strut (center illustration, 1).
Plug for CO adjustment (center illustration, 2).
If a CO analyzer with which small CO values can be measured is not available, create a plug connection for CO adjustment.
CO value is increased.

Control relay and intake-manifold heating relay are installed on the firewall (center illustration, 3).



The warning and diagnostic lamp is installed in the instrument panel (lower illustration, arrow).